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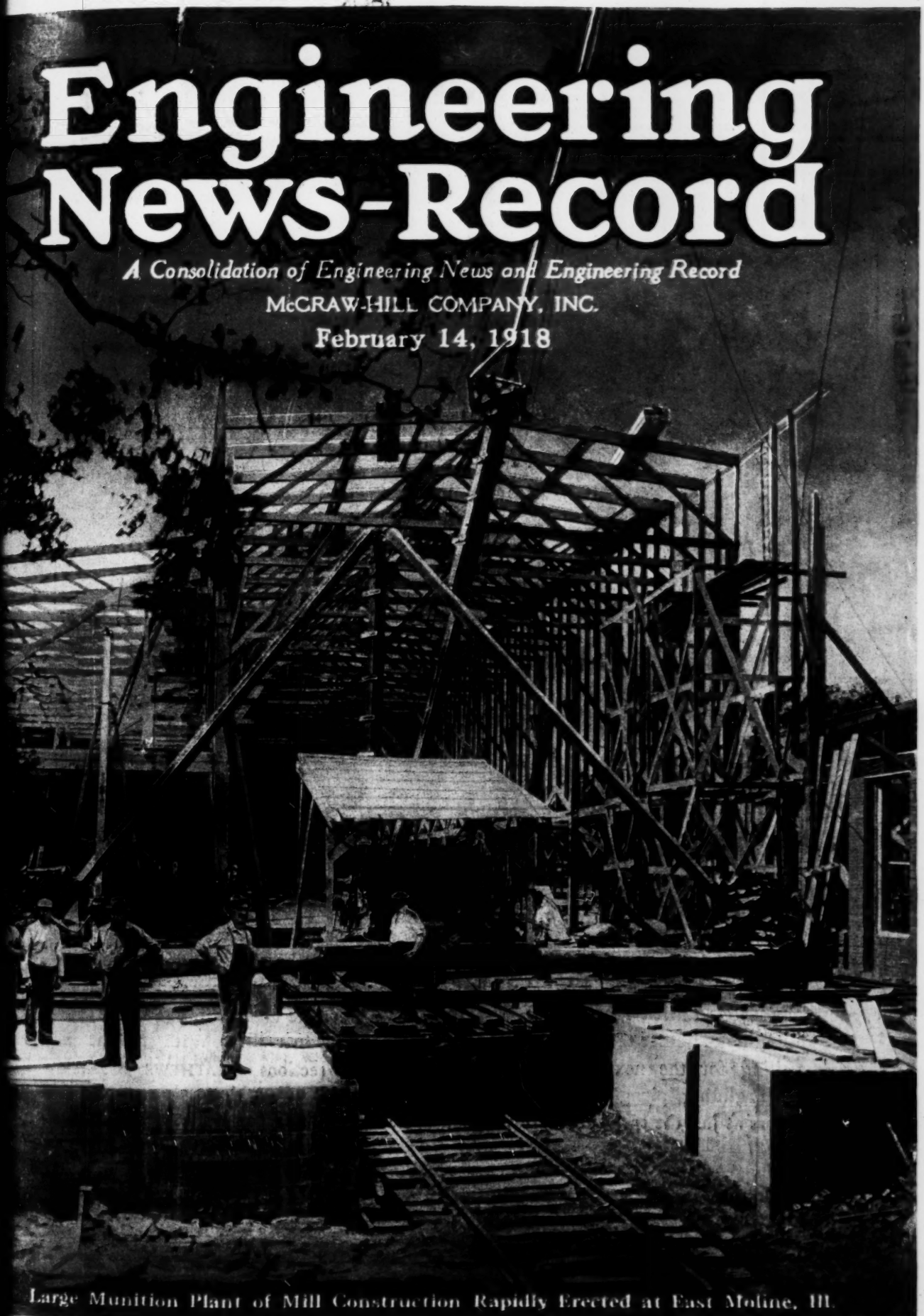

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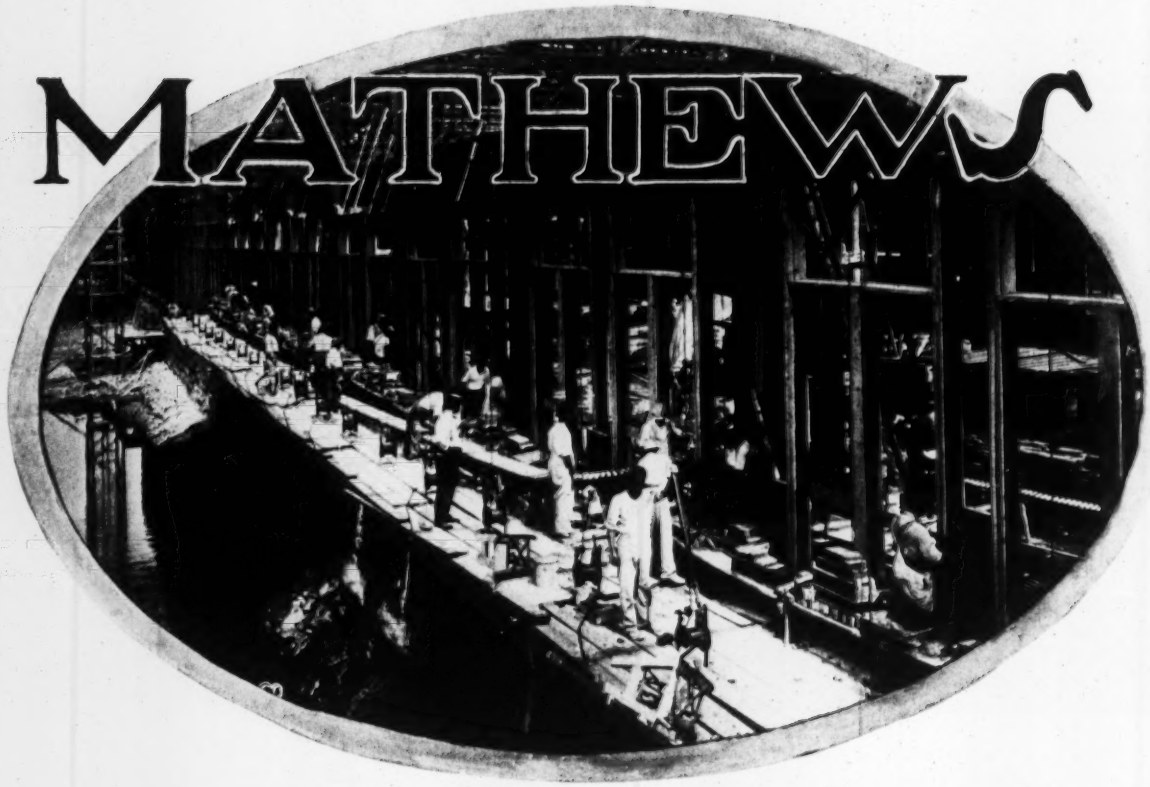

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

Volume 80 — NEW YORK, THURSDAY, FEBRUARY 14, 1918 — Number 7

What of the Production Situation?

THE country has drifted into a jam of its production processes from which it is proposed to extricate us by creating a ministry of munitions and a war cabinet on the one hand, or by granting unusual powers to the President on the other. It is entirely a question of engineering organization. This solution is coming, but it and the factors which can be utilized to hasten it are intimately bound up with the land and water transportation tangle, so fully discussed on these pages, and with the labor question, which is just beginning to be appreciated; and the solution does not depend on whether we have a war board or whether extraordinary powers are delegated to the President.

The present jam has been caused by the uncoördinated procurement of goods that cannot be transported. The mere creation of a war board or ministry of munitions, or the mere detailing to the job of some man of political or business prominence, cannot make the situation better until those selected have grasped the root of the matter and effected proper changes of policy and detail to meet the emergency. We can then go further and say that if these proper changes of policy and detail are realized, it makes no difference to the country whether they are put in effect by a war board or by the present administrative machinery.

The general public, Congress and not a few men in the Administration itself talk glibly of efficiency and coördination, but do not see that efficiency and coördination mean simply knowing the object to be reached, knowing the actual progress at each step of all the processes helping us toward that goal, and acting on the knowledge to regulate each one of the processes to fit the general scheme.

The basis of accurate readjustment must be scientific knowledge of what is going on in every branch of production. A ministry of munitions or the creation of a war cabinet would not guarantee the collection of this information, and conversely the information can be obtained and acted on by existing agencies. It is, then, the adjustment of our war production according to engineering principles, and not legislation on the subject, on which the fight of engineers for better administration must be centered, and centered at once.

What has been done and what is being done in Washington at this moment point the way to what must be done. A branch of the War Department, the Ordnance Bureau, which has been the target for severe and measurably unjust criticism at the hands of Congress is already organized so that it knows every detail every day of the progress of every contract being filled for it. Moreover, this department is acting on this information to coördinate its production, and meeting with striking success. Charts for every article and every factory working to produce these articles show the rate of production and its relation to schedule. These charts are sufficiently detailed to show whether lack of materials, lack of labor or lack of storage and transportation facilities is responsible for a lag in production, and to show it in plenty of time for the lag to be corrected. Experts in employment management, in handling labor, in transportation and in housing, visit plants, concentrate on special problems and iron out difficulties with almost miraculous results. Master charts for production divisions show those at the head where the different manufacturing processes on whole classes of articles stand, and a master chart for the whole department tells at a glance the relation of performance to promise. Those in charge of this department act promptly and effectively, because they act on accurate information.

This is the essence of the application of engineering principles to war. It is what engineers must fight for until the whole administration of the war is on such a basis. It can be accomplished without wasting energy on the side issue of whether the ideas of Congress are better than the ideas of the President as to the particular machinery to carry out such a plan. This reorganization is being accomplished in Washington today. Another great department which has come under the administration of engineers, the Quartermaster Corps, is fast straightening out on the same tack. Engineers are spreading the knowledge of what this method of attack will accomplish, and plans are afoot for extending it to the entire conduct of the war, regardless of legislation now pending.

Let us take heart. With the country on such an engineering basis there can be only one outcome to the war, provided the labor crisis precipitated by the industrial jam, out of which the way should now be clear before us, is handled wisely. Remember that the man who begged to have Germany placed on such a basis was jeered at the outset of the war, and that after he was sent for it took a year for that highly organized country to accomplish actually less than we have accomplished in nine months of haphazard work.

We must never stop until the entire conduct of the war, with all that means to the industrial life of the nation, is being based on exact military and political knowledge of our goal—which we have—and on accurate knowledge of the week-to-week and day-to-day progress of every step and process that helps us to that goal.

The First Centenary of an Engineering Society

AMID the stress of war the recent centenary of the Institution of Civil Engineers passed without ceremony in England and almost without notice in this country. Yet, founded at the beginning of 1818, this Institution is the oldest and perhaps the largest of civil engineering societies. The only note made of its one-hundredth anniversary was a statement read at the meeting of Jan. 8 last, before the presentation of the papers for the evening by Dr. J. H. T. Tudsbery, its secretary. For at the present time upward of 2700 of its members are in the armed service of Great Britain and 246 have already given their lives for their country. This toll has slightly reduced the maximum of 9266 members reached in 1914. From the present time, when the engineering profession is recognized as being of the greatest importance to civilization, to the founding of the Institution at Kendal's Coffee House in London by eight men, whose life work was not even recognized as a vocation, is a far cry. Since that time the Institution has accumulated a great engineering library, has published more than 4000 papers summarizing step by step the progress of engineering in many fields, and has established standards of professional conduct which influences English-speaking engineers the world over.

Water-Works Breakdown Shows Commission Plan Weakness

THE recent industrial shutdown at Harrisburg, Penn., due to a water famine caused by the breakdown of an antiquated pump, described on p. 316 of this issue, forcibly illustrates a great weakness of the commission plan of city government. Under that plan, with its combination of legislative and executive functions in a commission of five members, the chief administrative heads of the city are elected by popular vote. By virtue of office thus obtained the commissioners soon qualify in their own and the popular mind as experts, and either force experienced subordinates into the background or else dispense with their services entirely. The latter seems to have occurred at Harrisburg. Such happenings are a besetting danger even if not a probable concomitant of commission government. They are avoided in the commission-manager plan, the logical development of the commission plan, which has been adopted by a hundred of the commission-plan cities and might well be taken up without delay by the four hundred others which now choose their five managers by popular vote.

A Valuable Report on Labor Conditions Lacks in Completeness

SO quickly have conditions changed during this year of war that the report of the President's mediation commission, which would have passed unnoticed three years ago, has been featured as first page news. This is not due to the character of the report itself, for it contains nothing remarkably radical or revolutionary, nor have its authors held such a place of prominence in the affairs of the country that their findings should, for that reason alone, be noteworthy. One looking for the cause of this change in attitude on the part of the public, and the press which reflects public opinion, would find that the truth lay somewhere near the present-day realization that the mere legal ownership of an industry does not carry with it the right to manage it irrespective of the public welfare. For in this instance the trouble had arisen over the dangerous diminution in the copper supply traceable to industrial disturbances, in Arizona particularly; and, in lesser part, the hampering of the war program, both as to ships and aircraft, because of the chaotic labor conditions in the Pacific Northwest.

It would be fruitless to review the report itself. The story is as old as the machine age in which we live. For a century and more the present crisis has been preparing, waiting for such a condition as that in which we now find ourselves, to manifest itself as the ruling question. However much we would fool ourselves, no matter how deep we dig our heads into the sand of contentment with things as they are, we cannot escape the reckoning which is demanded by labor and forced upon us by our own best judgment. We must either face the new conditions squarely, seeking a solution in the fairness of compromise, or we will be compelled to submit to the destructiveness of a revolution in comparison with which the French Revolution would seem as a disagreement of South American political parties. This estimate is not the vapid dreaming of a labor sentimentalist, not the partisan warning of a labor demagogue, but the cold conclusion of most of the level heads in the country, among them prominent engineers. Strange as it may seem to the readers of *Engineering News-Record*, some of these men are wondering whether it is even now too late. They fear the stubbornness and self-sufficiency of the capitalist class far more than the unreasonableness of the laboring class. They know that the demands are far less than the concessions that can easily be made—far less, certainly, than the cost of the destruction that would be wrought through the anger and excesses of an American Bolsheviki.

On the point of what must be done to avert the impending cataclysm, the report of the President's commission is distressingly conventional when viewed in the light of modern economic studies. This, perhaps, is understandable and warranted in part by the need and weight of conciseness. But one looks in vain for the concreteness of the Whitely report to the English Parliament, and is hardly satisfied with the looseness of thought exhibited in the statement that "some form of collective relationship between management and men is indispensable." It would have been so simple to have suggested "shop committees" and the various forms up to a "joint standing industrial council" which made the English prototype so notable. On such a groundwork actual and substantial progress could have been made. Now we must wait for another occasion or another crisis to furnish another opportunity.

But in spite of deficiencies of this order, the report is valuable. The American mind is not of a texture identically similar to that of the Briton. It may be that the timeliness and urgency of the message may supply the rather obvious deficiency noted above. Time alone can answer this question—and time is, unfortunately, rather short.

A Possible Source of War-Needed Fats and Fertilizers

GLYCERINE must be had to produce explosives to win the world war. Nitrogen is demanded to raise the food crops on which the very will and strength to win the war depend. The sewage of our cities contains vast quantities of nitrogen and also of grease from which glycerine can be extracted and still leave a fatty residue for other uses. Can these vitally valuable materials be recovered without costing more than their worth? Can 88 of the 98% of water and with it the grease in sewage sludge be extracted and the dewatered, degreased sludge made available for the manufacture of commercial fertilizer?

The problem of recovering fertilizing material from sewage has challenged solution for half a century. Grease recovery has received less attention. Were it commercially feasible there would result not only the profit from the grease but also the enhanced fertilizer value of a grease-free sludge. If ever there were a time when any and every reasonably promising method of recovering fatty and fertilizing materials from sewage should be given a hearing, and on reasonable evidence a trial, it is now. Each material is essential. Patrictism demands their fullest possible recovery. Moreover, risk of loss is reduced by the high value of the products in question, and the possible rewards of success are great.

For several years past a process has been on trial in a small experimental way which has appeared to others than the promoters to give promise of commercial success. Reference is made to the Miles acid process of producing what it is hoped will prove to be an easily degreased and dewatered sewage sludge rich in fertilizing material. Elsewhere in this issue considerable space is devoted to efforts which have been made for nearly a year past to have the process tried on a large scale. Most of the article deals with a report on the practicability of recovering fatty and fertilizing materials from the sewage of Boston and vicinity, made by a joint investigating board at the direction of the Massachusetts legislature.

The board concluded that it would not be wise to adopt such a project at Boston until the process had been tested on a large working scale, and it did not favor the expenditure of money for such a test. In fact, it did not spend a cent of the $5000 which the legislature appropriated for its use.

Although the conclusions of the report just mentioned are not encouraging, *Engineering News-Record* strongly feels that the process in question deserves further study. This the report did not deny, except as regards Boston. Concerning the board's deductions as to Boston sewage, it should be noted that it compares 18 hours of plain sedimentation with an equal tank detention when using the acid process, whereas only a few hours' detention is the practice in the latter case.

Although urging further study, *Engineering News-Record* warns against drawing conclusions as to the general practicability of the process until it has been tested on a working scale, preferably at a number of different cities. Experience demonstrates beyond dispute that each new process of sewage treatment presents its own problems, sometimes many and diverse, on which experiences with other processes throws little light. Such has been markedly true of the activated-sludge process, which, it is well to remember, was also to produce a commercially valuable fertilizer, besides being a remarkably elastic self-contained process of sewage treatment.

If these were ordinary times, if fats and fertilizers were not so vitally essential as to make their cost almost secondary and not so high priced as to warrant large outlays for their recovery, the value of this new process of sewage treatment might await demonstration at the hands of its promoters. But in the present world emergency some public agency—city, state or national—might well share in the risk of a working-scale plant.

Housing Problem Frequently One of Local Transportation

ONE of the evidences that the Government departments are striking their stride and soon will be operating under conditions of efficiency against which no one can cavil is the work done recently by the Government in demonstrating that much of the clamor being raised for the purpose of securing emergency housing for this or that community can be stilled by demonstrating that the problem is one of local transportation. Chambers of commerce in many industrial sections have been seeking government subsidies for this purpose, seeing in their local situation and the national emergency a chance to build up their towns. Had every demand been granted, even when the need was apparent, the cost to the nation would have been almost beyond belief.

As for instance: A certain factory having large government contracts found that 40% of its machines were continually idle because of a labor shortage. The immediately suggested remedy was emergency housing, but a brief investigation showed that the cost of such a project would run to $750,000. The very size of this estimate called for pause, for the factory was only five miles from a city which had a labor surplus.

A not very extensive investigation revealed that the trouble lay in the fact that the electric traction lines, which had been attempting to handle the transportation of workers, had fallen down utterly because of a lack of coördination of existing facilities. A demonstration of this to the management of the three lines involved resulted in such a betterment of the service that the trouble of the plant in question was immediately eliminated. When the traction system broke down from lack of proper maintenance it was a matter of but a few hours to arrange with a railroad connecting city and plant to inaugurate a through train service of seven cars between the union station and the factory door.

Situations similar to this have arisen not once but many times within the past few weeks. With the railroads under government management such difficulties as the necessity of using two or more lines, which might have been an obstacle in the past, disappear. The query arises as to how many of the emergency housing projects, which have been filling the daily papers mainly because of their novelty and cost, will be found upon investigation to be *prima facie* evidence of hastily drawn conclusions and lack of study.

Washington Making Preparations Against Industrial Unrest

Employment Management Being Introduced in All Departments—Ordnance Division Organized Under Dean Schneider

By Mont Schuyler
Associate Editor, Engineering News-Record

CONCERNING the employment of labor in industrial or mercantile establishments, one fact stands out: No plant that has tried the services of an employment manager has ever abandoned this method of keeping labor peace and intensifying production. But though the idea is not new, it demands such numerous concessions from capital and management that many are reluctant to adopt it, and in some cases have even violently opposed the scheme as subversive of the social order and a breeder of revolution. To these men it will come as a distinct shock to realize that the government has not only accepted the idea in principle but has adopted it in practice. All very recent, this, and perhaps the first effects are hardly noticeable as yet. Until actual accomplishments can be pointed to, these same unregenerate ones will decry the advance as simply another instance of government meddling—not realizing that the government is now composed in major part of their own fellow private citizens who have volunteered their services and have been accepted because they have proved successful in private life. The old conception of Washington as the abode of the job-hunting politician must be changed. Certainly it does not hold under present conditions.

In the popular mind the war is to be won by treasure, or by vast armies, or by the universal support of this or that project which has received wide publicity for one or another reason. But in the opinion of the men who know, the truth lies quite otherwise. The factories, the mines, the farms, the railroad system, the highways—all the places where labor is employed in large amounts—these hold the key to final victory. Only through the intelligent handling of the *great problem of the management of men* may we expect success in the endeavor to produce munitions and materials in the amount necessary to the vast armies which we are raising and will continue to raise until we have reached the goal we have set for ourselves as a nation.

Industrial labor cannot and should not be put under military discipline, for if it is subjected to such domination—a thing hardly to be conceived of in this country—it will not produce to the last ounce of its strength. Machines may be speeded up to the limit of their design, or even beyond; but human beings rebel under a similar attempt, unless their hearts and minds are fast to their work through a loyalty that springs from a realization that they are being properly treated and that they personally are benefiting from their extra exertion. It is reassuring, therefore, to know that the Department of Labor has undertaken to convince labor that the guiding principle behind all employment on materials of war will recognize the rights of the man to good working conditions and such a wage as will insure him the standard of living to which he has been accustomed. Some say that the future holds even more; that society is due for a realignment which will be a new thing on this earth, and that these first steps hold every indication of being only the beginning of the journey.

Illustrative of the new atmosphere that is pervading Washington is the Industrial Service Section of the Ordnance Department. Headed by Herman Schneider, dean of the School of Engineering of the University of Cincinnati, this section is taking up all employment problems in each and every factory now manufacturing supplies for the department. Soon the other departments will be similarly provided, but an examination of the scheme of organization in force under Dean Schneider will supply at least a fair outline of the type of work which will fall to these totally new divisions of government work.

Nothing startlingly unique can be expected by anyone who is at all familiar with the work of the employment manager of a modern factory, but the very scope and significance of the Industrial Service Section will lead those who realize the advent of the new into fields for further thought. At this date, with the Bolsheviki in power and the industrial ferment in the Central Empires at a pitch which threatens their ability to continue resistance, the question of the division of profits between capital, management and labor—together with other matters which are seemingly secondary but vitally involved—is connected directly with the decisions which we as a nation make in this our hour of distress.

As may be seen from the accompanying organization chart, the complexity of the employment problem, when applied to the variety of industries falling under the more or less direct jurisdiction of the Ordnance Department, ramifies in several ordinarily unexpected directions. These finer subdivisions are perhaps dimly sensed by most employment managers, but the comparatively limited scope of any individual's work would ordinarily so reduce their importance that they would escape unnoticed—or at least unnamed. But in the intensive search for the underlying factors which enter in a problem of the size of this one, many things are brought to light which ultimately prove of value in more limited applications of the same broad principles.

The first major division shows that the difference between men and women workers has been recognized. With the substitution of female workers, which will be inevitable and which will go much further than most people believe, an entirely new category of questions

arise which require special handling. The peculiar province covered by this subdivision will, however, be left for later treatment.

Reporting directly to the head of the section are four distinct offices: Supply and Distribution, headed by Captain Boyd Fisher; Employment Management, under the direction of Major F. W. Tully; Local Transportation, for which no head has as yet been named; and Housing, which is at present in the hands of Perry J. MacNeille, who, it will be recalled, was responsible for the design and construction of the portable cantonment buildings described on p. 40 of the issue of Jan. 3. These four offices, together with Miss Mary van Kleeck as the head of the Woman's Sub-section, compose the Policies Board, which sits with the administrative head, Dean Schneider, in the determination of the broader questions upon which the detail of action is decided.

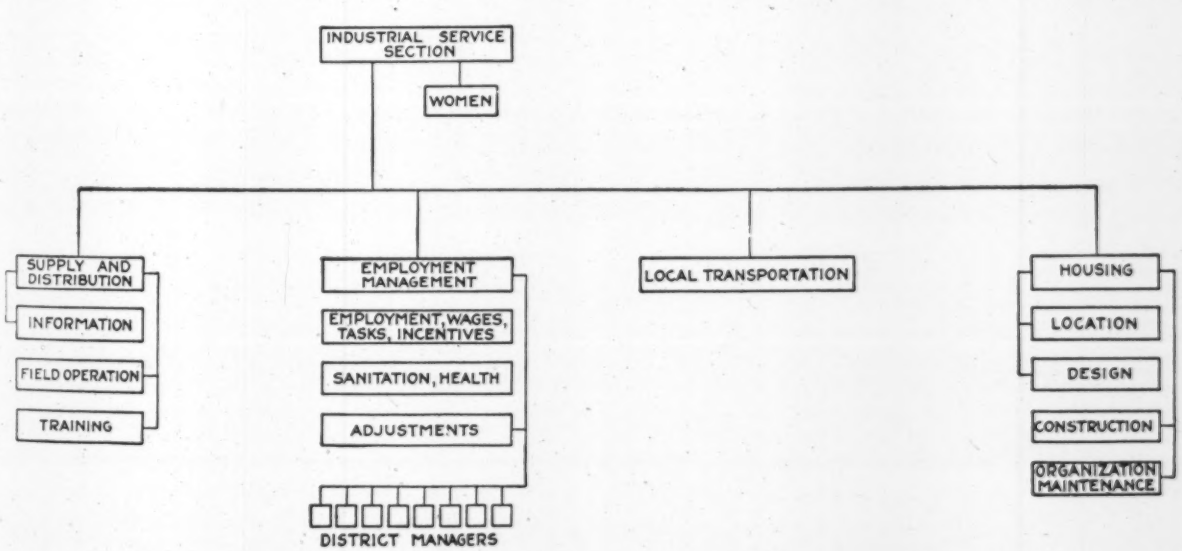
Without attempting to tie in with the organization chart, which is self-explanatory, the *modus operandi* of the section would be about as follows:

For one reason or another the production of a certain factory engaged in the production of materials of war shows a falling off. While this may be traceable to improper works management, in many more cases than are suspected the trouble lies with the methods of employing or handling labor. This is soon verified through the district managers, who investigate and report on the precise nature of the trouble—handling the incident, if possible, directly with the person in charge of the employment of labor at that factory. In more difficult cases the question is referred directly to the Washington office for advice or direction. If it seems necessary, a special agent will be sent to the plant, suggestions made and changes in methods brought about.

At this point trouble is likely to be encountered. Encrusted in old habits of doing business, the factory management may resist, or desiring to wash its hands of responsibility, may offer to turn the whole matter over to the government agency. Against such a chance and in full realization that there are hardly more than enough experienced employment managers for normal industrial demands, the section is preparing to call upon industries having employment departments to spare one or two persons of experience to supply the lack. It is going further, for in the very near future it expects to call upon the colleges and universities to inaugurate a special course in employment management. This course will be laid out by the general committee of all the Industrial Relationship sections which are coördinating under the general direction of the Department of Labor, and will be intensely practical. The textbooks will be such matter as is already in print as contributions from actual employment managers, and the instruction itself will be supplemented by lectures by these same men. The various industries needing help in establishing departments of this nature will be asked to nominate men from among their employees, and the selection of these people will be based upon a questionnaire describing the type of mind and personality which experience has demonstrated as best suited to the work. This list of questions is being drawn up by the same general committee which will have the courses of instruction under its direction.

But the trouble at another plant may be of another order. In place of worries with labor after it is once at work, there may be a shortage of labor, or a difficulty in getting sufficient housing of the proper sort—perhaps even such a seemingly minor matter as an inadequate local transportation system may so interfere with the productive capacity of the plant that a serious situation has arisen. This matter is studied with the same thoroughness, and if the local street railway cannot handle the morning and evening surge of workers, the Industrial Service Section will see that additional facilities, or other facilities, such as jitney buses, are supplied.

Housing has been so fully treated in previous issues of *Engineering News-Record* that it is not necessary to more than mention that this work, while it may actually be the province of another department so far as design and construction are concerned, will be under constant consideration. Furthermore the section will see that the provisions for sanitation and the health of the workers is maintained at the highest possible pitch,



PRESENT SCHEME OF ORGANIZATION IN ORDNANCE DEPARTMENT

for only under proper condition can even the most highly paid and satisfied of men or women produce the maximum.

Throughout all these activities will run the influence of the women's sub-section. Particularly, of a necessity, will its hand be felt in the proper provision for housing and sanitation, but it is bound to pay unusual attention to homes, wages and tasks. There are many places where the wage for female workers is so low that women of the requisite intelligence are not tempted, and there are jobs so fatiguing that no woman, unless she be abnormally strong, can remain at them for any length of time. It is becoming of increasing importance to give consideration to matters of this nature as the continuance of the war drains the nation of its manpower while still demanding a greater and greater productivity.

More than one of the volunteer workers in the Industrial Service Section has voiced the statement that the effects will last, that the end of the war will not witness a reversion to the old methods. And to support their views they point to the fact mentioned in the first paragraph of this article: No plant that has tried the modern method of employing labor, and of handling it after it is at work, has ever reverted to the discredited method. When it is realized to what extent the activities of the Industrial Service Section have already penetrated the industrial life of the country, it will be seen that the seed they plant will do more than a purely local good.

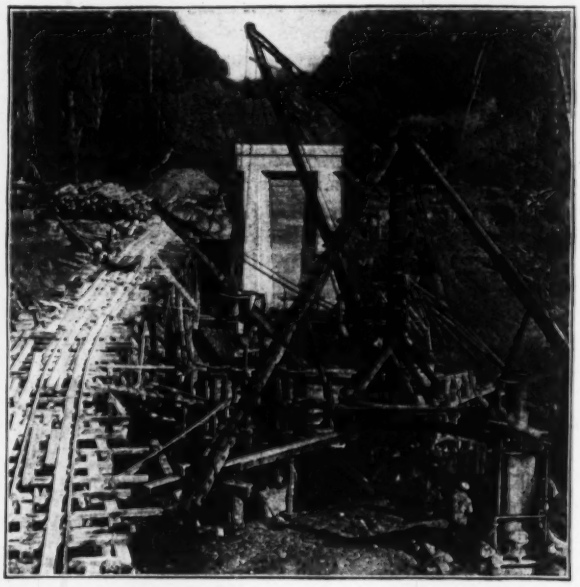
Trucks Need Wide Clearance in Snowdrifts

Motor trucks of the U. S. Quartermaster's recent convoy from Detroit to the Atlantic Coast experienced some difficulty owing to insufficient width of cuts through snowdifts. Instructions issued by the Government call for a minimum bottom width of 7 ft., with slopes of ½ on 1, giving 10 ft. clearance at a height of 3 ft. At open spaces and at low spots in drifts the full width of road should be cleared so as to form passing places. Where labor is available it is better to clear the full width instead of making narrow cuts.

Illinois Central Bascule Bridge Is Hand Operated

Limited Navigation Provided For by Plate-Girder Span Fitted with Counterweighted Lifting Truss and Gearing

POSSIBILITY of providing for the occasional passage of a steamer or dredge had to be considered in the design of the new bridge built over the Big Black River near Allen, Miss., by the Yazoo & Mississippi



CONSTRUCTION OF PIERS FOR BIG BLACK RIVER BRIDGE

Valley R.R. (Illinois Central System). The river is classed as navigable, but as the passage of vessels is very infrequent the requirements of the War Department were met by equipping one of the six 76-ft. girder spans with a hand-operated lifting device.

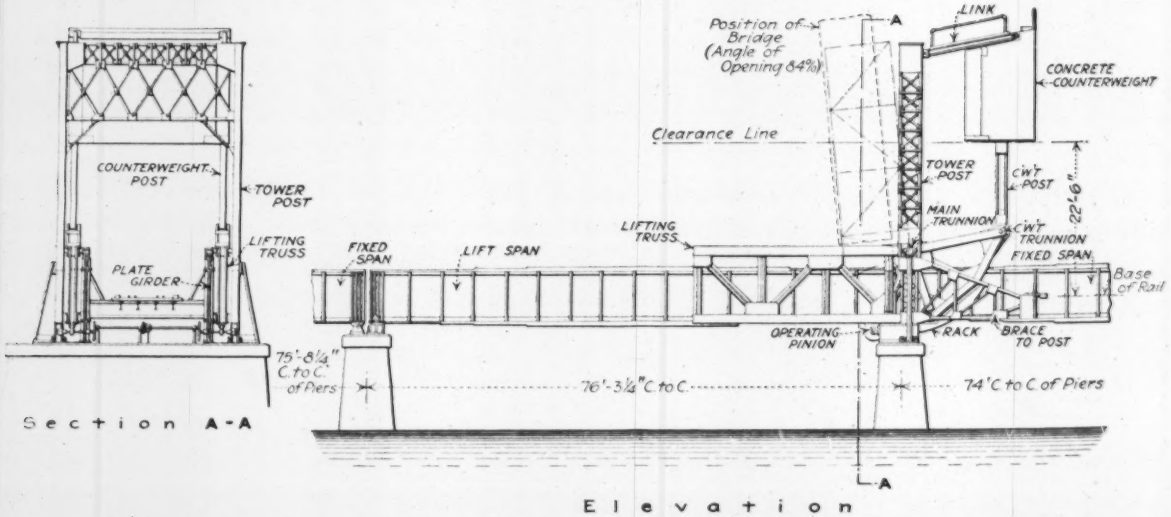
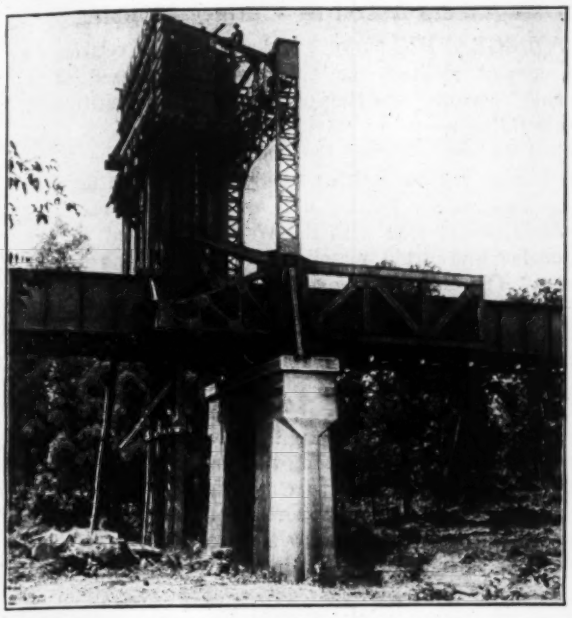


PLATE-GIRDER SPAN WITH HAND-OPERATED LIFTING GEAR



LIFTING TRUSSES AND GEARING FOR HAND-OPERATED BASCULE SPAN

For raising this span, a pair of short pivoted trusses is mounted on trunnions in posts on one of the piers, these trusses being outside of the plate girders and secured to them by riveted connections. The trunnions are in line with the top chords of the trusses and above the tops of the girders, so that in swinging open the span rises clear of its bearings. Curved racks under the counterweighted heels of the trusses engage the main pinions of a hand-operated train of gearing.

A 238-ton swinging concrete block above the track forms the counterweight. This block is supported from below by two posts resting on pins at the tail ends of the lifting trusses. The top of the block is held by links pivoted to it and to a steel tower or gallows frame on the pier, the columns of the tower being extensions of the outside posts which carry the main trunnions.

To operate the bridge, a portable hand capstan is fitted to the squared end of a shaft beneath the floor. The first part of the gearing is in the center line of the bridge and consists of a spur gear and two bevel gears driving a cross shaft. This latter carries pinions engaging spur gears on the shafts of the two rack pinions. The arrangement of capstan and gearing is shown in the drawing on the right.

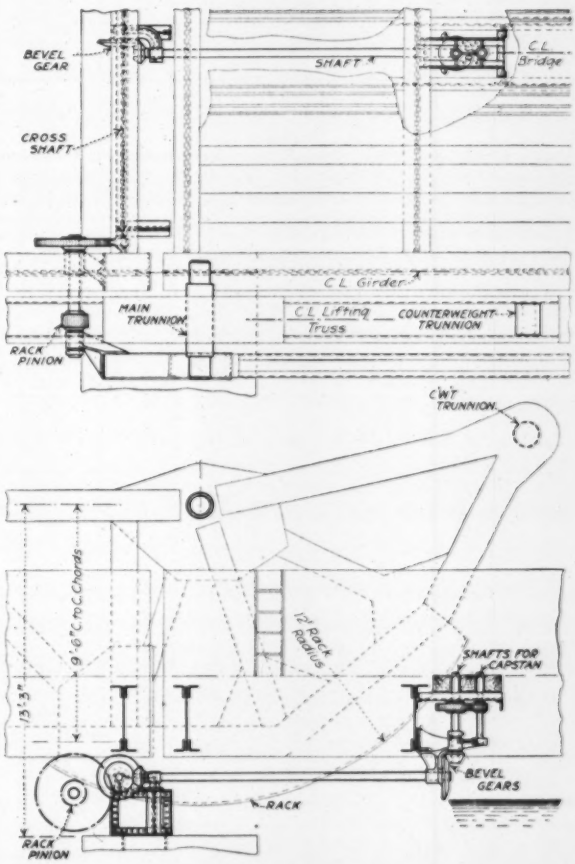
Time of operation is regulated by providing for two rates of speed, depending upon the force of the wind, any unbalanced load and the number of men available. It will be noted that each shaft of the first set of gears is fitted for the attachment of the capstan head, so that the bridge can be operated at the slower speed by turning the pinion, or at the higher speed by turning the spur gear, without throwing the pinion out of mesh. The gear ratio is such that two men can open the bridge in about 30 minutes.

Lock bars are pivoted to the front end shoes, and near the top of each bar is a handle nut. To lock the span in the closed position, the bars are swung into the jaws of castings attached to the moving leaf and the handle nuts are screwed hard against the jaws. As an additional precaution, the bars are secured in this position by padlocks.

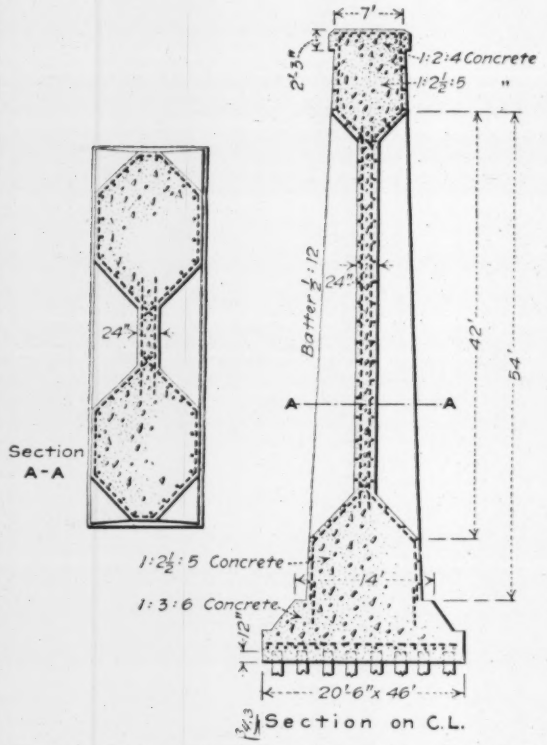
Substructure and foundations include six reinforced-concrete piers and an abutment. These rest on wood piles driven to a depth of 25 to 35 ft. and having their heads embedded 12 in. in the concrete. For the alluvial soil of the Mississippi Valley a load of 15 tons per pile is allowed. The bodies of the piers are of dumbbell section in plan, having two heavy sides or columns connected by a thin wall.

Cofferdams of Wakefield sheet piling were used for all the piers as a precaution against high water. However, the weather and river conditions were very favorable, and the channel piers were constructed while the water was only 5 ft. deep.

Plant for the concrete work included a ½-yd. Ransome mixer, two steam hammers, three stiff-leg derricks with hoisting engines, a power saw, an air-compressor outfit and a barge. A temporary trestle was built across the river for handling material. The mixer was on the south bank of the river and concrete was moved across the trestle in dump buckets mounted on a car operated by a continuous cable driven from one of the hoisting engines. The buckets were handled from the car to the forms by a derrick. Concrete work was com-



GIRDER SPAN CAN BE OPENED BY PIVOTED LIFTING TRUSSES WITH HAND GEARING



REINFORCED-CONCRETE BRIDGE PIERS ARE OF DUMB-BELL SECTION

menced Sept. 10, 1916, and was completed Jan. 11, 1917. Washed river gravel was used for the aggregate, but was first screened on account of its large percentage of sand. A derrick with clamshell bucket unloaded the gravel from cars and dumped it onto a large screen placed over the bin at an angle of 40°. The concrete was a 1:3:6 mix for the footings, and 1:2:4 or 1:2½:5 for the upper portions.

This bridge and 1200 ft. of ballast-deck pile trestle were built in advance of the grading for the approaches. Materials were moved over a temporary 7000-ft. branch line constructed across the bottom lands. A track pile-driver set the first four bents of the trestle, and a creeping driver mounted on rollers on the deck then completed the work. Foundations and concrete work were built by the Union Bridge & Construction Co., Kansas City, Missouri.

The lifting device for converting an ordinary girder span into a bascule span was designed by the Strauss Bascule Bridge Co., Chicago. The superstructure was manufactured by the American Bridge Co., and was erected by one of the railway bridge gangs. Two temporary bents were driven in advance of each pier to afford sufficient reach for a derrick car to land the 76-ft. girders. A temporary bent also supported the tail ends of the lifting trusses during erection, and falsework on the adjacent fixed span supported the form for the 238-ton concrete counterweight, as shown.

This structure forms part of the improvement for raising the line above flood level, as described in *Engineering News-Record* of Nov. 29, 1917, p. 1003. It was designed and built under the direction of A. S. Baldwin, chief engineer of the Illinois Central R.R. M. P. Black was assistant engineer in direct charge of the entire improvement.

Engineers Assist in Military Mapping

TOPOGRAPHIC surveys and mapping in relation to present military activities were discussed at a recent "patriotic" meeting of the American Institute of Mining Engineers by David White of the U. S. Geological Survey. During the disturbances on the Mexican border the authorities keenly realized the need of maps suitable for militay use, and arrangements were made in coöperation with the War Department for the extensive and rapid mapping of frontier and border strips. The entry of the country into the war crippled this, but there are 38 parties of topographers in the field, and the survey is now covering—on a scale of 1 mile to the inch—betwen 100,000 and 200,000 square miles per month.

Before the war broke out, said Mr. White, many of the members of the topographical branch of the survey, by virtue of their engineering training and interest, had entered the Army Reserve Corps, and after the outbreak of the war a large proportion of the field engineers were enrolled in the military service. The survey has now 100 men wearing the uniform of the United States.

Topographic mapping is essentially under army control or advice, although the engineers are detailed to the Geological Survey and are operating under George Otis Smith, director, who is a member of the Military Committee. About 40 members of the topographic staff are in France, engaged in making the surveys as the lines are moved up to the front, and in mapping the recovered ground. This reduction in numbers has made it necessary to conduct a training school for topographic engineers. More recently the army has come to the help of the survey by detailing to it—from the volunteers and draft camps—men who are found on examination to have had training suitable as qualification for topographic mapping.

"In connection with the detachment that has gone to France," said Mr. White, "I might mention an interesting experiment in the application of the rapid topographic plane-table triangulation from observation stations for locating enemy batteries, in order that they may be the more quickly paralyzed and given the least possible time for the removal of guns. How successful that has been, I do not know.

"The entrance of the United States into the war naturally created an enormous demand for maps of different kinds. The War Department and Navy Department immediately realized the very great necessity for cartographic work. The engraving division of the U. S. Geological Survey accordingly reproduced and furnished to the Navy all of the admiralty charts which a very greatly enlarged navy will need in this work. We have at the same time worked diligently to secure rare maps and unpublished maps of parts of our own country and of foreign countries. These have been furnished to the Army engineers and to the War College.

"I wish to give a grateful vote of thanks to the many engineers attached to the oil and mining companies engaged in foreign exploration who have so loyally given their unpublished maps for the use of the U. S. Government. We have published a great number of maps for the War Department, and are now doing a rather novel bit of work in issuing a series of maps for the

use of the air service. These follow the conventions of the French and British airplane maps, and are to be used by our aviators in the training camps in order that they may be accustomed to the reading and interpretation of such maps when they get to France. A paper published about a year ago on the use of photographic and topographic mapping, a bulletin by Mr. Bagley, promises to be invaluable to the allies and to Americans alike in the reproduction of aviation photographs and their interpretation in map form."

Minnesota Drainage Work Checked

Overdevelopment and War Conditions Have Lessened Construction—Hungry Europe Demands Conservative Reclamation

By E. V. Willard
State Drainage Engineer, St. Paul, Minn.

THE current stocking up of drainage work in Minnesota suggests a brief retrospective and prospective review of the state drainage situation. It will be shown that the check in drainage work is due to overdevelopment as well as to the heavy indebtedness of some of the counties concerned, the high prices of labor and material and war conditions generally. The growing use of tile drainage will be noted and attention will be called to the need for a well-considered but conservative program which will bring all available productive land into use without the expenditure of funds to little purpose—all with war conditions of this and European countries in mind.

During 1917 drainage activities in Minnesota have been conducted on a somewhat smaller scale than in the previous two or three years. This is especially true of the northern section where the construction of open ditches through the large marshes had been progressing at an unprecedented rate.

An almost complete network of open ditches has been completed through the larger swamps. Many land owners, too, feel that the construction of ditches on a large scale through unimproved and practically uninhabited areas has resulted in reclaiming lands faster than a demand for them has developed. A more conservative practice to meet actual needs may be looked for. The heavy bonded debt incurred by some of the counties through the financing of drainage ditches has no doubt also resulted in discouraging some of the work which has been under contemplation. Farmers in Minnesota are fast learning the value of tile drainage. As land values become higher, the demand for increased production becomes greater, and more intensive farming must be practiced. The draining of his low and waste lands is the quickest and most permanent step to be undertaken by the farmer to bring about this result. Tile drainage, while mostly practiced in the southern part, is moving northward by rapid strides. It is now being practiced universally in all sections south of St. Cloud, and to a large extent as far north as Crookston. Approximately $1,250,000 worth of drainage work has been awarded to contractors during the past year, and of this amount about one-half has been for tile drainage.

The new year comes with a feeling of uncertainty among drainage officials and contractors. As regards the landowners, the year just ended was an unusually dry one in the sections where marshy lands predominate, and the abnormally heavy precipitation of 1914, 1915 and 1916 which speeded the initiation of a large number of drainage proceedings, was lacking to remind the land owner of his low land and to give impetus to the work. At least two large flood-prevention schemes, initiated in the early part of 1917, have been temporarily laid over due to this cause. A large snowfall this winter and prolonged spring rains would cause renewed activities, while a dry winter and spring would make this year unusually quiet compared with any of the past five years.

As regards the contractors, they are all worried, and are agreed that these are troublesome times. The drain of man-power by the national army and the inducement offered to skilled machine operators by the government are causing a dearth of labor, especially of the skilled classes, making the payment of higher wages for inferior men imminent. It is almost impossible to buy fuel at any price. The prices paid for repairs and supplies have advanced from 30 to 200% in two years. Those who own and are able to equip old machinery have a decided advantage in bidding for new work, as the advance in cost of new equipment introduces an item which must be taken care of by the contractor who has to equip under present war-time prices of machinery.

An advance over last year in the cost of excavation of from 10 to 25% is expected. The increase in the cost of material will result in an even greater advance in the cost of building bridges and other structures. The high price of labor, as well as the advance in the price of drain tile, will result in an increase of probably 20% in the cost of tile drainage.

The counties have experienced some difficulty during the year just ended, especially in the last six months, in selling their drainage bonds except at an increased rate of interest. It is expected that this condition will be intensified in 1918 because of the activities of the administration to secure the investment of available funds in government bonds.

Drainage Work Should Be Encouraged During the War

Starving Europe is looking to this country for meat and bread. If we are to do our duty and perform the work which is expected of us, every acre of agricultural land should be made to do its bit. Lands which have been drained and high land not in need of drainage should be made to produce grain, while lands too wet and marshy for that purpose should be drained and made to produce hay and feed for live stock. The drainage on a large scale of lands on which no actual settlers reside, or which will not be used for agriculture, hay or grazing lands during the period of the war should be discouraged, but the drainage of the low and unproductive tracts on farms under cultivation should receive special attention. Within the area of Minnesota which has been substantially occupied all the easily developed portions are being utilized. But if we are to win the war by the production of food supplies we must increase production by taking up the waste places—the swamp, the hill-slopes, the worthless shallow lakes—and converting them into fields of grain.

Wood Ore Docks Are Removed and Piles Pulled Up

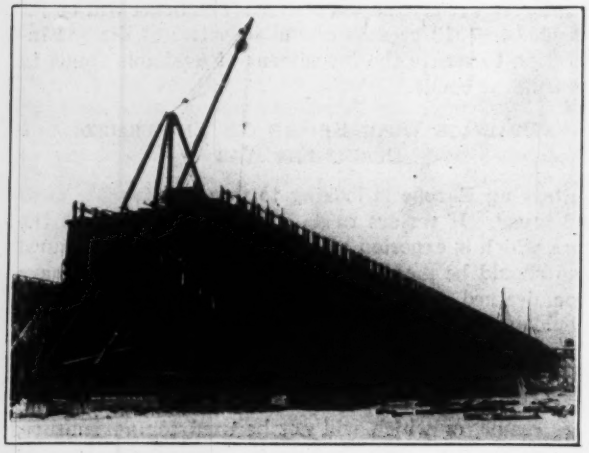
Track Derrick Is Used in Wrecking Superstructure—Floating Derrick with A-Frame Pulls Foundation Piles

REMOVAL of two timber ore docks of the Duluth & Iron Range R.R. at Two Harbors, Minn., was carried out in 1917. In one case the foundation piles were pulled, but in the other case were left in place.

Dock No. 3 was demolished first. This was built in 1905 and could have been repaired for further use but that its location interfered with the handling of boats at the new steel and concrete ore dock No. 2, described in *Engineering News-Record*, Aug. 9, 1917. It was therefore removed entirely, the foundation piles being pulled and the foundation cribs and filling dredged out. This dock was 66 ft. high and 1054 ft. long, with 170 pockets. The length is exclusive of the trestle approach, only a part of which was removed.

A timber traveler with 60-ft. boom and double-drum steam hoisting engine was used by the contractor. This was carried on track rails on the top or deck of the dock. It pulled out the timbers and landed them on a car alongside the traveler. The timbers were unloaded in the yard by a derrick mounted on a car, and were then cleaned, sorted, reloaded and put in storage piles by the contractor. Wrecking was unusually difficult owing to the comparatively good condition of the structure. The amount of timber removed per day was about 85,000 ft. b.m.

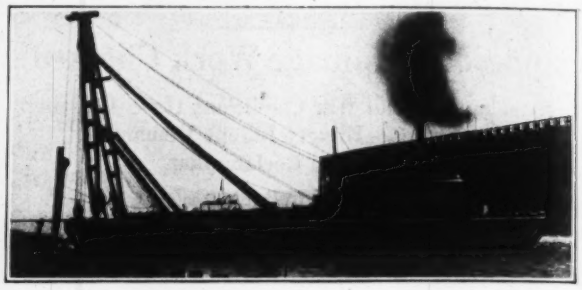
Pulling the foundation piles was done by means of a scow 32 x 80-ft. having a double-drum hoisting engine and lines leading over a heavy steel A-frame. By means of two sets of five-sheave blocks a pull of 110 tons could



TRAVELING DERRICK WRECKS SUPERSTRUCTURE OF ORE DOCK

be exerted. This machine removed 2835 piles in 35 days, or an average of 81 piles per day. The piles were of white and Norway pine, 30 to 50 ft. long, with a penetration of 15 to 25 ft. in the stiff clay of the lake bottom. About half of them stood inside the timber cribs, with the rock filling extending nearly to their tops Some were inaccessible for the pulling equipment. These were cut off by the bucket of the dipper dredge, which followed the pile puller, dredging out the cribs and underlying material to give the necessary depth of water. About 38,000 cu.yd. of material was removed by the dredge.

Ore dock No. 4 was then removed. It was built in 1892-93, and partially rebuilt in 1901-02, but was beyond repair. It was 62 ft. high and 1042 ft. long, with



PILE-PULLING SCOW HAS STEEL A-FRAME AND TWO SETS OF FIVE-PART TACKLE

168 pockets. Only the superstructure was removed, using the traveling derrick noted above. Progress was about 106,000 ft. b.m. daily, the work being easier than on the other dock.

Each dock contained about 5,500,000 ft. b.m. Of the timber from the newer structure about 20 per cent. was sound and suitable for resawing into lumber, and 20 per cent. was sound but not fit for resawing. Of the timber for the older structure only about 12 per cent. was good enough for resawing, while the other sound timber amounted to 17 per cent. The remaining timber was useless for structural purposes but much of it was sold for firewood.

The Stack Construction Co., Duluth, Minn., had the contract for removal of both superstructures. The Great Lakes Dredge and Dock Co., Chicago, did the dredging and sublet the pulling of the piles to Whitney Brothers Company, Superior, Wis. Work was done under the direction of W. A. Clark, chief engineer of the Duluth & Iron Range R.R., who has furnished information concerning it.

Maintenance Cost Is Given for Asphalt Paving Under Automobiles

Cost of maintenance of asphalt paving carrying heavy automobile traffic is given in a paper read before the Western Society of Engineers by George C. D. Lenth, assistant chief engineer of sewers, Board of Local Improvements, Chicago.

The traffic on Michigan Ave. amounts to from 700 to a maximum of 1350 automobiles per hour, as was shown by a census made in 1917. In the narrow stretch from Randolph St. to River St. the congested traffic

COST OF PAVING RENEWALS ON MICHIGAN AVENUE BETWEEN RANDOLPH AND RIVER STREETS, CHICAGO

Year	Yardage Repaired Sq.Yd.	Per Cent. of Total	Cost of Repairs	Per Cent. of Original Cost	Cost per Sq. Yd.
1913	16	0.27	$45.62	0.84	$2.89
1914	178	2.97	192.02	3.55	1.08
1915	302	5.04	314.48	5.81	1.04
1916	503	8.42	565.70	10.45	1.12
Total	999	16.70	1,117.82	20.70	1.12

is confined to a roadway only 38 ft. wide. Originally this was a granite-block pavement, laid in 1888 on a base of macadam and cinders. Automobile owners made complaint against its roughness, and pending the widening of the street it was decided to surface with asphalt as an experiment.

After cleaning the granite-block paving and raking the dirt out of the joints, the blocks were painted with asphaltic cement. On this was laid a sheet-asphalt surface having a minimum thickness of 2 in. This work was done in June, 1913, at a cost of 90.4c. per sq.yd. for a total of 5985 sq.yd.

Cost and amount of maintenance on this resurfaced pavement are shown in the accompanying table. The figures do not include overhead expense, which in this case amounts to about 20%. At the end of 3½ years 16.7% of the original surface had been replaced.

Adjacent portions of Michigan Ave. are 75 ft. and 85 ft. wide. From 12th St. to Jackson Blvd. 35,402 sq.yd. of 2-in. asphaltic concrete has been laid on a 6-in. concrete base. This was done in 1909 at a contract price of $66,457, which included a 5-year guarantee. The maintenance cost during 1917 was $415, or about 1.17c. per sq.yd. From Jackson Blvd. to Randolph St. there are 19,500 sq.yd. of 2-in. asphaltic concrete on a 12-in. macadam base. This was laid in 1911 for about $30,000. Its maintenance cost in 1917 was $450, or 2.3c. per sq.yd.

Local Society Management Demands More Consideration

Modern Structural Principles of Group Activity Should Govern Organization and Methods of Engineering Societies—Choose Officers with Care

By C. E. Drayer

Secretary, Committee on Engineering Coöperation, Cleveland

At a time when the local engineering society is gaining so rapidly in recognition and influence but is still in the formative state it seems desirable to consider more fully than has yet been done some of the principles which should govern its organization and management. The subject is so broad that only a few features common to all local societies can be considered.

Often when a society is being organized much time is spent uselessly in framing a long constitution calculated to meet all future conditions. This presumes that the members of the society in the coming years will not be mentally equipped to care for situations confronting them. It indicates also an attempt to foresee the lines along which the future activities of the society is a mobile, flowing thing, serving its purpose best when allowed the greatest latitude to conform to the will of its members. The ideal constitution should embody organization structural principles only and provide for nothing except members, officers and money. Details should be left to by-laws, which should be few and easily amended to meet changing conditions. A long constitution tempts parliamentarily inclined members to epidemics of revision. No constitution can insure interest and loyalty, from which spring enthusiasm and initiative.

Broadly speaking, a society exists to do what the individual cannot do—develop its members to become successful both in the practice of their profession and in all their duties as citizens. This implies class consciousness. Other classes—doctors, lawyers and labor men—have demonstrated for years the value of acting in unison. Every engineer who has thought carefully on the subject has voiced the conclusion put in practice long ago by other classes, that unity is primarily within the province of the local society. State and national unity are merely larger measures of local unity.

Responsibility for the conduct of the society centers in the president and his immediate advisers, in whom the various lines of activity are harmonized. Careful provision should be made against choosing for officers men whose claim to the honor rests on distinction attained in the practice of the profession rather than wise and untiring leadership in the society. Equal care should be taken to guard against perfunctory, haphazard or clique choice. Probably the best way is to have a standing nominating committee whose business is to study constantly the growing timber in the membership and see that only those are put up for office who show true leadership, not mere persistence in work. Creative imagination, ability to interpret the heart, to say clearly what his fellows feel and to inspire loyalty, are necessary qualities for chief officers.

If a society has sufficient income to hire an executive secretary, a great deal of thought should be given to his selection, for on him perhaps more than on even the president rests the chance for success. The president usually changes each year, but the secretary may continue for many years. Prominent among the qualities desired in the secretary is vocational aptitude, which comprehends pleasing personality, ability to converse in a convincing manner and the power to stimulate the individual member to do his part. In no small measure the society will fulfill its mission if the individual member can be made active. An analysis of almost any society voluntary in character will reveal that its strength, its organized coöperation, is due to loyalty to some individual. Fortunate is the society that can pay this tribute to its secretary. Such a man has the incentive of his own success coupled with that of the society to become familiar with the laws of modern group activity, developed from the experience of successful organizations. He should be of the caliber to be trusted with authority not only in the business management of the society but to represent it in the absence of the chief officers in those delicate civic relations where even the right may lose if not tactfully presented.

Committees are divided into standing and special. The former have to do with the regular business of the society, such as property, finance, program and membership. The latter are created to care for special problems from time to time and exist until their work is completed.

A society member once facetiously remarked that he had been on a committee for two years but never found it had committed anything. A strong executive has been credited with defining an effective committee as composed of three men with one member out of town and one dead. Both remarks have been widely cited as a way of saying that it is an unusual committee that does continuous and effective work. The fault is not so much with the committee as with the kind of work expected of it, composed as it is of men who have numerous and important duties outside of the society.

It would be better to recognize a committee as mainly a deliberative and advisory body which must be provided with machinery to carry out its findings. This is usually done by the chairman or by a secretary provided for the purpose. The average civic-commercial body, such as a chamber of commerce, usually has sufficient funds to provide the necessary secretarial assistance—and herein lies the reason for the amount of work done by the committees of such bodies. If the young engineer can be found with time at his disposal to act as committee secretary, it will take from the busy older men routine detail and afford the youngster a fine opportunity to gain experience and make useful acquaintances. There is no more valuable asset for the engineer at the threshold of his career than a favorable acquaintance with the leaders of the profession.

Competent Chairman Gets Results

The surest way to get a committee that produces is to place at its head a man who is competent and will work. The head of a great business recently said: "The secret of organization is to pass the buck to the right man and see that he does it." Courtesy has thus far prevented any president of a society from removing the chairman of a committee because he stagnates. Detail management takes time from the president already burdened with work. A suggested solution tried with success more than once is found in a steering or managing committee whose duty is implied in its name.

Of the standing committees none is more important than the program committee. Despite the usual limitation of funds, a strong program of diversified interest must be presented. What does the membership want and what does it need? We can discourse at length on the duty of each engineer to support a local society for the good of the profession and the good of the community, yet fall short if we fail to realize that the altruistic appeal is second to the selfish. The society must give service liberally to pay the average member for his outlay of time and money. Provision must be made to supply the papers on the latest theory, design and practice. The program committee or a similar one must provide the opportunity for the membership to gain the benefits that arise from personal contact and social intercourse. Smokers where the technical gives way to stories that melt the ice of diffidence must have a place. It must be recognized that the engineering society is in competition with other civic organizations. Hence the old style of society must give way to a program of action frequently recast and vitalized by innovation.

The most important membership asset of the society is the young man. It should be easy for him to find himself a member even while an undergraduate. He should be trained assiduously in the way he should go in organization work. Inasmuch as he is anxious to prove himself in his life work, provision should be made for him to gain recognition for meritorious work in the society. Some societies provide a junior grade in which the charge to the young man is lower than the cost to carry him as a member.

Apply Test of Usefulness to Activities

Among the early ambitions of all societies is the desire to obtain permanent quarters, establish a library and start a publication usually called the "Journal." The desire is to give the society a physical body, a material evidence of existence. Even the sacred institutions of library and publication should be compared unflinchingly for usefulness with other activities in which the society may engage. Unless there are funds for adding new books and for cataloging in public library fashion to make the library a working tool, the society had better acknowledge that its boast of a library is empty and make arrangements with the local public library to make the books useful. Such arrangements have been made by two local societies. Reference work of the average member is more to articles in current technical magazines than to texts, hence nearly complete files of current technical magazines are a necessity. Bound periodicals dating back say five years and the latest and best books in the several engineering fields might well constitute the working library of the local society. One large local society maintaining perhaps the largest library of its kind in the country found that it could present to each member asking for a book an order for the purchase of the book and come out ahead financially at the end of the year.

The "Journal," as published by several societies, may be defined as a publication in which papers presented before the society are preserved in permanent form and is differentiated from the "Bulletin," published rather frequently and partaking more of the character of a news sheet. In a recent observation it was found that not more than 10% of the members examined the journal with care or read some of the articles. It would be an instructive experiment to place the journal on its own footing, making a budget to include voluntary subscriptions and other income, and charging against it all legitimate costs, including proportion of office expense and overhead. In suggesting such a study it is recognized that not every activity can be expected to pay its way. For instance, no one concerned in club management has been discovered by the writer who could make the dining room pay its way. Yet a club without dining facilities is hardly a club.

The Need of Cost System

The above remarks directed to time-honored institutions of engineering societies implies that a cost system should be set up if the same efficiency in the use of money is to be approached as is reached by many members in their factories. Most societies make a budget, but none has said, for instance, how much it costs to collect dues and conduct the other activities that absorb a large part of the time of paid assistants. A successful manufacturer knows to the hundredth of a

cent what his costs are, but an engineering society goes along blithely until the money is gone; then it raises dues or curtails necessary work. The annual incomes of several local societies pass the $10,000 mark. It would be well to have a standard system of cost accounting so that the results attained in one society could be compared with those of others.

Bridge Work in Guatemala Torrent Used Armored Tower

Rail Fenders on Heavy Pile Support in Boulder Bottom Resisted Two Ten-Foot Floods—Car Wheels Swept Away

BUILDING a falsework tower in a torrential stream was the key problem of a bridge replacement job in Guatemala, Central America, reported by W. T. Penney, steel contractor, of Guatemala City. The power of the torrent was great enough to move car wheels, which were tried as riprap or pavement around the base of the tower. The tower as built—see the views herewith—stood throughout the work, however, and permitted the dismantling of the old truss and the erection of the new, while traffic on the line was not interrupted.

The work was done in 1914 on what was then known as the Occidental Railway, now part of the Ferrocarrils Internacionales de Centro America. The line was built about thirty years ago, when light engines were used and bridges built accordingly. With change of ownership heavier engines were bought to reduce operating expenses. Bridge replacement was undertaken at once, and the erection had to be done in the season of the most unfavorable river conditions.

The river crossed by the bridge in question, the Samala, is considered one of the worst in Central America. It drains the volcano Santa Maria, only about 30 miles upstream, and because of the steep slope of the country and the heavy rainstorms quick floods come down the river. The water sometimes rises 15 ft. in two hours. Floods do not last more than a few hours, however, the water falling as rapidly at it rises. The river bottom is made up of round boulders varying in size from a billiard ball to a one-yard stone, rolled down from the mountain slopes and carried along by the river. In flood time some of the small boulders occasionally bound out of the water.

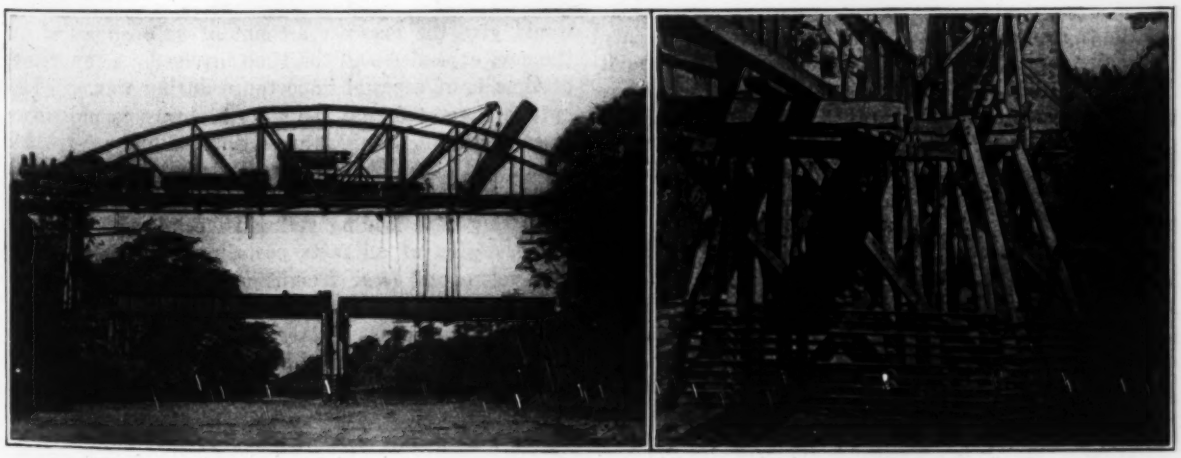
The old Samala bridge was a pin-connected bowstring span 180 ft. long center to center, although the channel is only about 100 ft. wide at the crossing. The method of replacement had to provide for keeping up the regular traffic, consisting of four trains daily. A successful plan of operation was devised and carried out by Mr. Penney.

It would have been impossible to put falsework bents into the river in the usual way. The railway company had some 60-ft. plate-girder bridges on hand, however; by placing a pile tower in the middle of the river the girders could be used to form a support for the erection falsework. It was possible to place the girders from the existing bridge, handling each in two sections, field-spliced at the middle of the girder span.

The tower was built of 70-ft. piles driven to a penetration of 4 to 6 ft. through the sand and among the boulders. This gave a good toe hold against the current. Three bents were driven, heavily braced—all connections bolted and drifted—and additional piles driven to form a cutwater at the upstream end. The tower was sheathed with railway rails 6 in. apart, the cutwater, similarly sheathed, forming a point directed upstream. The rails were intended to take the impact of the boulders and deflect them away from the pier, and they did the work.

The half girders, lowered by derrick car from the old bridge above, were supported at midspan on a temporary support consisting of a 12 x 2 x 30 hung from the truss bridge by 1½-in. manila rope falls. When one-half of a girder was set, the other half was lowered and the splice made with bolt and drift pins. Erection of the falsework on this tower and replacement of the truss then went on as a routine operation. During the whole of the work no train was delayed.

To prevent scour riprap consisting of 100 old car wheels had been placed around the foot of the tower, the river bed being exposed at low water. The very first rise of the river, which occurred at night, swept all the wheels away. The disappearance of the wheels was the next morning's surprise. A little later one of the wheels



BRIDGE REPLACEMENT ON SAMALA RIVER, GUATEMALA—TIMBER TOWER SHEATHED WITH STEEL RAILS CARRIED 60-FT. PLATE-GIRDER SPANS ON WHICH FALSEWORK BENTS WERE SET

was discovered on a sand bar near a bend about 500 ft. downstream. All the other wheels had been swept on around the bend of the stream. These wheels weighed 200 lb. apiece.

In spite of the tremendous violence of the current displayed by this action, the tower stood through two 10-ft. rises of the stream without any damage, and the bridge renewal was successfully completed.

When the rails were removed from the sides of the tower on demolishing the temporary structure they shone like silver dollars. The passing boulders had polished them bright.

Laying Out and Justifying a Program for Road Work During War Times

Matter Should Be Studied from a Strictly Engineering Point of View—Assumption as To Duration of Conflict Necessary, Since Many Decisions Must Be Based Thereon—Local Materials Should Be Used

Among road engineers the question as to the decision to be made concerning construction during this year is of great interest and vast importance. The paper prepared by George C. Diehl, Engineer of Erie County, New York, and presented before the recent convention of the American Road-Builders Association, is given here in a condensed form as a competent estimate of the nature of the problem.

ROAD construction at this time might be divided into three classes: (1) Those which assist in the war program; (2) those which retard the war program; (3) those which do not interfere with the war program. There are so many ways in which roads are of value that in order to simplify this discussion only that point of view will be considered wherein highways assist the railroads. The present difficulties in railroad transportation are well understood, and the problem, as it is now directly presented, is that haulage over highways should release locomotives and cars and relieve congestion at terminals and freight houses.

The roads in class 1 might be subdivided into roads which radiate from railroad shipping points and those which parallel railroad lines. As railroads are now overcrowded, radiating roads are not so urgent. The principal effort should be concentrated on roads which approximately parallel railroads.

Even to superficially study this subject it is necessary to assume a period for the duration of the war, as it is apparent that if the war were to end within a year the improvement of these parallel roads should be temporary and speedy, letting the permanent improvement wait. One congressman has said that it is far better to prepare for a war of seven years and have it last seven months, than to prepare for a seven-months' war and have it last seven years. It would therefore seem wise to assume that the war will last three or more years, and on this theory the parallel roads which are to be constructed should be built in the most substantial and durable manner.

The elements which enter into this problem include availability of local material, time required for construction, ability to provide suitable detours, and the number of cars and locomotives which would be released. It is apparent that if two roads were of equal length and other conditions were equal, the road built of local material, without using railroad haulage, would be the most desirable. Likewise a road that could be built in the shorter time would be preferred, and in order to preserve a continuous line of traffic it would be necessary to prepare detours to carry traffic during construction.

In considering the various forms of traffic it may be assumed that through travel generally cannot be carried on highways, and that construction is primarily for the purpose of moving local travel. This might be divided into: (1) Passenger; (2) freight; (3) express; and (4) mail. The possibilities of moving passengers by motor vehicles are almost unlimited, providing suitable roads are furnished, as there are in this country today over 4,000,000 passenger cars and these have a greater capacity in passcenger miles than all of the coaches on the steam and electric railroads combined.

Between the neighboring cities in many sections of the East it is even now possible to motorize local passenger business. This would eliminate possibly 75% of local passenger trains, and if through-passenger trains refused to carry local passengers, a considerable percentage of through-trains would be eliminated.

Local freight, especially the smaller units, would be likewise transported by motor. Local express and mail packages could be carried over the highways and all of these combined would bring great relief to the railroads. This problem is very complicated and many elements must be considered to determine which roads would give the greatest amount of railroad relief for the sum expended and the time involved. The element of time is of especial importance during war.

It is suggested that the state highway commissioner in each state determine the sections of highways which would best serve this purpose and that in so doing he could arrive at the result through a volunteer committee consisting of a leading railroad official, who would be in possession of all facts pertaining to the character and volume of local freight and passenger business, and a representative from chambers of commerce or commercial bodies. This committee, cöperating with the manufacturers of road-building equipment and road materials, could determine the construction which would afford the greatest relief with the least disturbance.

For a long time it has been clear that the townships throughout the United States have not sufficient taxable assets to warrant taxes of the large amount required

to maintain the highways and bridges, and without going into detail it appears to be growing more and more apparent that the township should be abolished as a unit of highway administration, leaving the state and county to carry on the work outside of the incorporated places. These agencies could provide the necessary funds, especially with Federal aid.

Economic theories of railroad construction have been developed so that it is possible for the railroads to determine the exact expenditure which would be justified to eliminate a foot of rise and fall or a degree of curvature, and if the highways are to carry the enormous motor vehicle travel which is anticipated, then similar economic theories should be developed for highways. Before fixing a maximum grade, it would be necessary to determine whether trailers were to be used, and if so the total weight of the trailers and load as compared with the hauling engine.

Every highway department should have a traffic engineer, as the problems of traffic are so intimately connected with construction and maintenance that these problems must be worked out jointly. The traffic department should take a frequent traffic census, as a controlling factor in many cases will be the cost of moving one ton one mile, and in order to determine accurately data must be kept, which will be invaluable after a period of a year or two.

Charts can be prepared showing the relation and classes of traffic in proportion to population and amounts of production. The curves on charts prepared in states where improved highways are most prevalent would indicate to a considerable extent the type of construction, and other questions of an engineering nature.

It is altogether likely that not more than two or three types of construction can be adopted; namely, reinforced concrete pavement, monolithic block pavement on concrete base and possibly bituminous concrete laid by the so-called mixing method. The various other forms of macadam will probably not be suitable on the main highways. Without going into detail in this matter, reports of the cost of maintenance of various state highway commissions where great mileage of roads have been constructed substantiate this statement.

It is important also to consider the width of the highways, as with the ever-increasing traffic widths heretofore adopted will prove inadequate. To illustrate this by a concrete example, if we assume an improved 16-ft. highway, generally considered a double road, and operate 3-ton motor trucks at a speed of 15 miles an hour, on a half-minute headway—that is, about 600 ft. apart—120 trucks or 360 tons could be transported in either direction every hour. In a 10-hour day, 3600 tons in one direction, or 2700 tons in both directions, could be conveyed. This would mean only the amount carried by one or two modern freight trains. Thus it will be seen when the tonnage exceeds this, unless there is operation by night and day, that the roads must be wider than 16 ft. If passenger traffic is carried over the roads, they must be still wider.

To design highways and bridges intelligently, maximum loadings must be adopted. The railroads of the country have been reconstructed several times by reason of increasing weight of rolling stock. To design a railroad bridge it is necessary to have not only the maximum load, but the wheel concentrations and distance between such concentrations. A similar plan should be adopted in highway construction. Motor vehicle manufacturers could construct cars consistent with such loading.

The cost of highway construction bears a definite relation to tonnage. Assuming that the enormous contemplated increase occurs, then the public must be prepared for highway expenditures far in excess of the amounts heretofore appropriated, particularly with reference to main trunk lines—the lateral roads can be constructed more economically of the less expensive types.

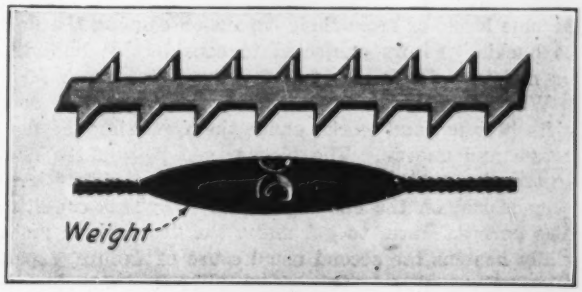
Submarine Saw Removes Weeds in Streams and Lakes

Flexible Steel Blade Lying on the Bottom Is Drawn Back and Forth, Cutting Off Plant Growth at Roots

CLEARING weeds from irrigation canals on the Orland project of the U. S. Reclamation Service, at Orland, Calif., is done by means of a submarine weed-saw. This consists of a flat flexible tape of special steel, with serrated edges, as shown in the accompanying drawing. The saw is $\frac{1}{50}$ in. thick and $\frac{5}{16}$ in. wide in the body. The teeth are spaced $\frac{7}{16}$ in. c. to c. and have a base and height of $\frac{1}{16}$ in. In manufacture the saw is tempered so as to have several twists in its length. Tapered iron weights are secured at intervals of about 3 ft. to keep the saw at the bottom of the canal.

Particulars of the work have been furnished by R. C. E. Weber, assistant engineer of the U. S. Reclamation Service, at Orland, Calif. The saw is operated by two men, one at each end, who draw it to and fro by means of ropes attached to the ends. One man keeps in advance of the other, so that the saw lies diagonally across the canal. Cutting is started at the lower end of the section to be moved, and is worked upstream.

The aqueous growths found in the Orland canals consist of water buttercup and two varieties of pond weed. After cutting, the weeds float down stream with the current, and a force consisting of 3 to 5 men is required to remove them from the water. For this purpose 3 x 12-in. planks are placed across the canal, about 6 in. above the water. From these a grate is made by placing 1 x 4-in. pieces in a slanting position from the bottom of the canal to the top of the plank or walk-



FLEXIBLE WEIGHTED SAW FOR CUTTING WEEDS IN CANALS AND STREAMS

board. The dislodged weeds float against the grating and are removed by means of ordinary 4- or 5-tine forks.

The rate of progress of the work depends upon the size of the canal and the amount of growth. Recently a half-mile section of the North Canal heavily grown with weeds was cut at a cost of $35 per mile. The dimensions of this canal are 8 ft. bottom, 2: 1 side slopes and 2 ft. water depth. The discharge at the time of mowing was 40 sec.-ft. Mr. Weber states that no other method of removing this weed growth has been found that in efficiency or cost compares with the submarine saw.

This tool, known as the Ziemsen submarine weed saw, is made by Aschert Brothers, of Cedar Lake, West Bend, Wis. It has been used in numerous cases on Government, municipal and private work. It can be operated in lengths of 150 to 300 ft., and handled either from the banks or from boats. Owing to its flexibility it accommodates itself to the contour of the bottom of the stream or lake and thus cuts off practically all growth near the roots. The metal is tempered to stand the continual twisting and bending, so that breakage is not frequent. A broken saw is readily repaired by lapping the ends and wrapping the splice with wire. The weights are in two pieces, put together with screws, and can be attached as desired.

Unusual Moisture Conditions Destroy Creosoted Block Floors

Should Wear Indefinitely if Well Laid—If Shrinking or Swelling Occurs, Unevenness and Splitting Follow

[*At the recent convention of the American Wood Preservers' Association much attention was given to the use of creosoted wood blocks for factory floors. A committee report on the proper method of treatment, handling and laying was presented, and Lambert T. Ericson, contracting engineer for the Jennison-Wright Co., Toledo, Ohio, read a paper from which the following has been condensed.*]

CREOSOTED wood block floors seldom fail from decay. If properly manufactured and treated and properly installed they wear indefinitely, but when the floors do eventually fail it should be from wear alone. Occasionally, however, they do not give the long and satisfactory service which is expected of them. When premature failure occurs it is usually either from unusual shrinkage of the blocks, which causes them to become loose, or from their expansion causing the floor to buckle. Floors subjected to considerable humidity or moisture frequently fail for the latter reason.

When the blocks become loose, foreign matter soon sifts between and works under them, making the floor rough and uneven. The blocks then have a tendency to travel with the traffic and, as they get out of level, soon broom on the end and break up. This condition also permits water to get under the floor, which materially hastens the second usual cause of failure, expansion. Expansion at this stage will cause the floor to buckle, since the joints are full of incompressible matter. However, excessive moisture will cause the floor to buckle under any conditions unless proper provision is made to accommodate the resulting expansion.

In relaying a floor after buckling, it is difficult to restore the original surface. Any unevenness will hasten splintering.

Expansion joints, an inch or thereabout in width, should be always placed along all walls, and around columns, machine bases and other fixed points. Expansion joints of this width cannot be placed across the traffic without resulting in depressions and rough spots. Inasmuch as creosoted blocks have been known to expand five per cent. in passing from the dry to the saturated state, a floor 60 ft. wide would, under similar conditions, expand 36 in. Of course this percentage of expansion is the extreme limit and improbable of occurrence; still it is obviously impossible, where variable conditions of moisture exist, to take care of expansion merely by means of expansion joints along the walls and columns.

The logical and practical way to take care of expansion is by filling each and every joint with a compressible and waterproof material. In rectangular blocks most of this expansion occurs at the ends. The width of end joints required can be calculated very closely and when this is done and the requisite provision made, no trouble will be encountered.

Especially where dry or heated conditions are to be encountered, one of the most essential requirements is that the lumber shall be absolutely air-seasoned. Inasmuch as untreated lumber will contract more than six per cent. in volume in passing from the green to the dry state, it should be apparent that there is no possible way to keep blocks tight in the floor if any such condition of shrinkage is to be encountered after their installation. That would mean that a block measuring 4 in. wide by 8 in. long would contract ¼ in. in width and ½ in. in length in drying out. It is a fact that lumber well air-seasoned will shrink further when subjected to steam-heated conditions, but it is possible to offset this shrinkage by the use of a plastic filler between joints.

Floors that are to be constantly subjected to moisture or to humid conditions are an exception to this rule. They should be manufactured preferably from only partially seasoned lumber; or, if dry lumber is used, it should be subjected to live steam to swell the blocks during the treatment. This condition, however, is not a usual one, and merely illustrates the impossibility of laying down rules that will fit all cases. It is also frequently advisable to use a heavier oil treatment.

The matter of the foundation for the floor is also very important. It goes without saying that if the foundation gives way the surface will do likewise. Concrete of the requisite depth and composition to withstand the expected load should always be used, unless it is impossible for other reasons. If timber is used, it should be given a preservative treatment to prevent decay. In modern factory construction, however, it is seldom that concrete cannot be used.

The advisability of the use of a cushion between the concrete and the blocks is a matter of much debate. It should be remembered that when one is used its sole function is to level up the inequalities of the concrete base, to afford the blocks an even bearing and to permit them to be surfaced smooth by rolling or tamping.

Wood-Block Pavement Failures of Southern Cities Analyzed

Bituminous Filler Found To Give Uniformly Good Results Regardless of Method of Treating Timber—Sand Cushion and Filler Deficient

Authoritative information as to the behavior of pavement types under various definite conditions is of first importance. Perhaps no type has been more subject to criticism on account of errors in design than has the creosoted-wood block. The paper read by C. H. Teesdale, of the Forest Products Laboratory, Madison, Wis., before the recent convention of the American Wood Preservers Association, from which the accompanying matter has been taken, gives the municipal engineer much important data on the relative values of sand and mortar cushions and sand and bituminous fillers.

EXAMINATION of wood-block pavements in 13 southern cities was made in 1917 by the Forest Products Laboratory to obtain information on the service experience with various methods of treating and laying. Almost without exception, satisfactory service had been obtained when a bituminous filler had been used, regardless of whether light distillates or heavy tar-oils were used. There was very little evidence of trouble resulting from poor treatment, or to the quality of oil used, but sufficient trouble from shifting sand-cushions was noted to condemn this method of construction, even though there is a slight saving in cost compared with mortar cushions. The numerous satisfactory streets where proper construction methods were used, prove that wood block can be successfully used in southern cities if proper methods of construction are adopted.

Most of the pavements inspected were laid within the last six years. Southern yellow pine was used in all cases, and usually the treating records showed that the blocks were green and were steamed before treatment. The earlier specifications called for from 16 to 20 lb. of heavy tar oils. The pavements were usually laid on sand cushions and filled with sand fillers.

The development of very serious expansion trouble in these pavements led to a quite universal change in the specification early in 1915. Imported English distillate oil was substituted for the heavy paving oils, and the blocks were laid on a mortar cushion with asphalt filler. As a rule, green timber steamed before treatment was used as before.

Sixty-one pavements were investigated, but four of these, originally laid with sand cushion and filler, had been relaid with bituminous filler. Thirty-two were treated with heavy tar oils and 33 with light oils; 35 had sand filler and 30 bituminous. Swelling troubles which necessitated relaying considerable areas of pavement are included in the column of "Serious trouble," while all other cases of expansion which were found or reported are included under "Slight trouble."

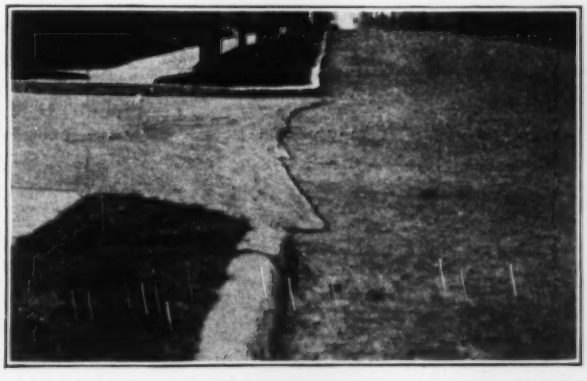
Of 35 pavements laid with sand filler and cushion, 23 gave serious trouble and eight gave slight trouble from expansion. Only three pavements of the 35 gave no expansion trouble, and one of these had been in service but a few weeks when inspected. The blocks had bled severely in each of the three exceptions, probably helping to waterproof the surface.

Thirty pavements were laid with bituminous filler, 20 of them on mortar and 10 on sand cushion. None gave serious trouble from expansion; four gave slight trouble and 26 gave no trouble. Of the four giving slight trouble, three were laid on sand cushions: one of them between the rails of a street railway, one other used liquid petroleum instead of asphalt or pitch for filler; and both of the other cases occurred on bridges.

It will be noted that of 32 pavements treated with distillate oils, 23 were laid with bituminous filler; and of 33 treated with heavy tar oils, only seven were laid with bituminous filler. Serious trouble occurred with either oil when sand filler was used and did not occur when bituminous filler was used. In four cases, where the blocks were originally laid with sand filler, so much trouble was experienced that the entire pavements were relaid, using bituminous fillers, and no further trouble developed.

There is little doubt that nearly all of the expansion trouble—certainly in every case where it was very severe—was due to the use of sand filler. Good and

BLOCKS UNRESTRAINED BY CURBS EXPANDED FREELY. CRACKS FILLED WITH SAND WHEN BLOCKS DRIED OUT



SURFACE OF SHEET ASPHALT DISPLACED BY SWELLING BLOCKS LAID ON SAND CUSHION WITH SAND FILLER

Complete Data Indicate Failure of Sand Filler and

	City	Date Laid	Kind of Cushion	Kind of Filler	Remarks	No. of Sq. Yd.	Width Brick Wore In
1	Mobile	1905	1-in. sand	Sand	Expansion and bulging; 1% decay in sapwood	4,793	20
2	Mobile	1905	1-in. sand	Sand	Expansion and bulging; 1% decay in sapwood	7,575	24
3	Mobile	1905	½-in. sand	Sand	Expansion and bulging; 1% decay in sapwood	655	24
4	Shreveport	1910	1-in. sand	Sand	Expansion started 1916. Bled very severely 1910-11. Some decay on under side	1,600	37
5	Shreveport	1912	1-in. sand	Sand	Expansion occurred very soon. Displacement of curb. Part relaid in 1914, asphalt filler	14,000	36
6	Shreveport	1912	1-in. sand	Sand	Continual trouble from expansion. Curb pushed out of alignment, and trouble on account of shifting cushion	5,300	36
7	Shreveport	1912	1-in. sand	Sand	Continual trouble from expansion. Curb pushed out of alignment, and trouble on account of shifting cushion		36
8	Shreveport	1912	1-in. sand	Sand	Continual trouble from expansion. Curb pushed out of alignment, and trouble on account of shifting cushion		
9	Shreveport	1912	1-in. sand	Sand	Not much expansion trouble. Some bleeding		
10	Shreveport	1912	1-in. sand	Sand	Excessive bleeding, first and second years. Trouble from expansion		
11	Shreveport	1912	1-in. sand	Sand	Bulging, bleeding and shifting of cushion		
12	Austin	1912	1-in. sand	Sand	No expansion trouble. Bled very heavily		
13	Austin	1913 1914	Sand	Asphalt pitch	1913 blocks, poor penetration: expansion trouble: 1914 blocks: better penetration: very little trouble	3,752	
14	Austin	1912	Over 1-in. sand	Sand	Considerable expansion and buckling trouble, less frequent now		
15	Austin	1909	1-in. sand	Pitch	Slight expansion trouble on one side of street only		
16	Beaumont	1911	1-in. sand	Sand	No expansion, trouble, but bled very heavily	19,120	
17	Beaumont	1911	1-in. sand	Asphalt	Perfect condition, no expansion trouble. Bled severely		
18	Beaumont	1912 1913	1-in. sand	Sand	Bulging. Some blocks relaid in 1915 with asphalt filler have given no trouble. One street treated with heavy tar oil and laid with asphalt filler disintegrated, due to shifting sand cushion caused by vibration of a steam railway		
19	Dallas	1914	1-in. mortar	Asphalt	Some trouble from swelling. At points blocks removed along curb	23,800	44
20	Dallas	1913	1-in. sand	Sand	Buckled about one year after it was laid. No trouble since	15,224	30
21	Dallas	1913	1-in. sand	Sand	Considerable expansion after about one year. Curb displaced. Surface is now excellent	14,631	30
22	Dallas	1914	1-in. mortar	Asphalt	Excellent surface, no trouble from expansion	11,029	30
23	Dallas	1915	1-in. mortar	Asphalt	Excellent surface, no trouble from expansion	4,882	36
24	Dallas	1914	1-in. sand	Asphalt	Excellent surface, no trouble from expansion	1,019	36
25	Dallas	1912	1-in. sand	Sand	Buckling started in 6 months. Month after pavement was laid bled heavily: continued two years	23,376	30
26	Dallas	1914	1-in. sand	Asphalt	No trouble	8,623	43
27	Dallas	1912	1-in. sand	Sand	Some swelling in about one year. At present in good condition	6,641	40
28	Dallas	1915	1-in. sand	Asphalt	No trouble	20,741	36
29	Dallas	1915	1-in. sand	Asphalt	No trouble	7,646	32
30	Dallas	1912	1-in. sand	Sand	No trouble until 1917 when cushion shifted slightly	4,166	50
31	Dallas	1912	1-in. sand	Sand	Buckling trouble not serious. When blocks buckled sand cushion had a tendency to shift, causing 1 per cent of blocks removed on account of decay in sapwood	10,956	32
32	Dallas	1912	1-in. sand	Sand	Some trouble from shifting cushion due to vibration of street railway and buckling	12,703	32
33	Dallas	1915	Mortar	Asphalt	No trouble	5,253	52
34	Dallas	1908	2-in. sand	Asphalt	No trouble	514	
35	Dallas	1910	1-in. sand	Sand	Severe expansion trouble caused repeated buckling. In 1915 re-surfaced, using mortar cushion and asphalt filler. No further trouble	8,657	50
36	Dallas	1911	1-in. sand	Sand	Severe expansion trouble caused repeated buckling. In 1915 re-surfaced, using mortar cushion and asphalt filler. No further trouble	21,491	52
37	Dallas	1913	1-in. sand	Sand	Trouble month after laying. Part relaid before acceptance. Blocks relaid from rail to gutter. Swelling and shifting of cushion	2,957	36
38	Dallas	1911	1-in. sand	Sand	Expansion trouble within 90 days. Entire street relaid, 1915, using mortar cushion and asphalt filler. No trouble since	15,767	52
39	Dallas	1911	1-in. sand	Sand	Expansion trouble about two years after laying. At present rather rough	10,200	52
40	Fort Worth	1913	Sand	Sand	Not much expansion trouble. Relaid one city block as cushion was washed out by broken water main. A mortar cushion would probably have prevented		
41	Fort Worth	1916	½-in. mortar	Sand	Surface now excellent. No expansion trouble		
42	Galveston	1915	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	1,538	48
43	Galveston	1914	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	1,580	48
44	Galveston	1915	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	3,221	48
45	Galveston	1915	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	1,702	38
46	Galveston	1914	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	1,823	38
47	Galveston	1915	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	1,333	38
48	Galveston	1915	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	1,917	38
49	Galveston	1916	1-in. mortar	Asphalt and sand	No expansion trouble. Good condition	6,134	48
50	Greenville		Sand	Sand	Bulging, and shifting of sand cushion. Most trouble along car track which has poor foundation		
51	Houston	1911	1-in. sand	Sand	Considerable expansion trouble and buckling. Blocks broken by heavy traffic. No expansion joints used	4,386	45
52	Houston	1912	1-in. sand	Sand	Considerable expansion has forced curb out of alignment. Since 1913 considerable wood block laid on mortar cushion, asphalt filler. Excellent satisfaction	7,684	46
53	Longview	1911	1-in. sand	Sand	Severe swelling in 1913: relaid about 40% with sand-cushion and sand filler: continued trouble since. At present, bad condition and heavy maintenance	16,000	
54	San Angelo	1913	1-in. sand	Sand	Trouble every rainfall. Some streets in worse condition than others. Expansion started at tracks 9 months after pavement was laid. 15 to 40% of blocks broken. Resurfacing at an early date. Small section relaid with mortar cushion and asphalt filler has given no trouble.	42,000	70
55	San Antonio	1915	Mortar	Asphalt	Excellent condition, no trouble	2,949	71
56	San Antonio	1916	Mortar	Asphalt	Excellent condition, no trouble	15,246	75
57	San Antonio	1914	Mortar	Asphalt	No expansion trouble, except between street car tracks	5,428	42
57	San Antonio	1914	Mortar	Asphalt	Excellent condition, no trouble	4,933	40
59	San Antonio	1916	Mortar	Asphalt	Excellent condition, no trouble	647	35
60	Waxahachie	1912	½-in. sand	Asphalt and sand	Some expansion trouble, altho not severe. In one location 2 in. sand cushion used; shifting of cushion noticeably greater at this point	8,000	60
61	Wichita Falls	1911	Sand	Sand	Most blocks have given trouble from expansion and buckling. Some blocks bled considerably for over a year		
62	Wichita Falls	1913	Sand	Asphalt	No expansion trouble		

Sand Cushion Type of Creosoted Wood Block Pavement

	Kind of Traffic	Car Tracks	Depth of Blocks, In.	Depth Concrete Base, In.	Sp. Gr.	Preservative Kind	Absorption, Lbs. per Cu. Ft.	Treatment
1	Light. Residence St.		4	4		Oil specified to equal "Kreodone"	18	Steam and vacuum.
2	Light. Residence St.		4	4		Oil specified to equal "Kreodone"	18	Steam and vacuum.
3	Light. Residence St.		4	4		Oil specified to equal "Kreodone"	18	Steam and vacuum.
4	Moderate Businness St.		4	18		Heavy tar and creosote oil.		
5	Light. Residence St.	Two	3			Heavy tar and creosote oil	20	
6	Light. Residence St.		3			Heavy tar and creosote oil	20	
7	Light. Residence St.		3			Heavy tar and creosote oil	20	
8	Moderate. Business St.		3			Heavy tar and creosote oil	20	
9	Moderate. Business St.		3			Heavy tar and creosote oil	20	
10	Moderate. Business St.		3			Heavy tar and creosote oil	20	
11	Moderate. Business St.					Heavy tar and creosote oil	20	
12	Light. Business St.		3	5	1.10 or over	Heavy tar oil	20	
13	Light. Residence St.	Between rails				Heavy tar oil	16	
14	Light. Business St.		3	5	1.10 or over	Heavy tar oil	20	
15	Heavy. Business St.							
16	Light. Residence St.					Heavy tar oil	22½	
17	Fairly heavy. Business St.		3½			Heavy tar oil	22½	
18					1.03-1.08		18	
19	Moderate		4		1.055	English distillate	18.2	Steam 4 hours; pressure 25 lb.
20	Light. Residence St.		3½	5	1.07	English distillate with 15% tar	20.1	Steam 6 hours; pressure 25 lb.; vacuum 4 hours, 21 in. Maximum oil pressure 100 to 135 lb.
21	Light. Residence St.		3½	5	1.07	English distillate with 15% tar	18.1 to 18.2	Steam 4 hours; pressure 20 lb.; vacuum 2 hours, 21 in.
22	Light. Residence St.		3½	5	1.068	English distillate	18.1 to 18.2	Steam 4 hours; pressure 20 lb.; vacuum 2 hours, 21 in.
23	Light. Residence St.	Two	4	6	1.067	English distillate with 15% tar	18.5	
24	Light. Residence St.	Two	4	5	1.06 to 1.10	English distillate with 15% tar	18	
25	Light. Residence St.		3	5	1.11 or over	Heavy tar mixture	20.5	Steam 4 hours; 15 lb. pressure; vacuum 2 hours; 22 in.; maximum pressure, 180 lb.
26	Heavy. Business St.		3½	6	1.08	English distillate with 15% tar		
27	Moderate. Business St.		4	6	1.12 or over	Heavy tar oil	20.2 to 20.5	Steam 6 hours; pressure 20 lb.; vacuum 22 in.; maximum oil pressure 100 lb.
28	Light. Residence St.	Two	3½	5	1.08	Distillate oil with 15% tar	19	Steam 3 hours
29	Moderate. Business St.		3½	6	1.08	Distillate oil with 15% tar	19 to 20	Steam 3 hours
30	Light.	Two	4	5	1.11 or over	Heavy tar mixture	20	
31	Light. Residence St.		3½	5	1.11	Semet Solvay heavy tar mixture	20 to 21	Steam 4 hours; pressure 35 lb.; vacuum 2 hours, 22½ in. Maximum oil pressure 105 to 110 lb.
32	Light. Residence St.	Two	3½	5	1.11	Semet Solvay heavy tar mixture	20½	Steam 6 hours; pressure 35 lb.; vacuum 2 hours, 22 in. Maximum oil pressure 115 lb.
33	Heavy. Business St.	Two	4	6	1.04 to 1.08	Distillate oil specified	18	
34	Heavy. Business St.		4	6	1.045	Distillate English oil	20	
35	Heavy. Business St.	Two	4	5	1.10 or over	Heavy tar oil	16	
36	Heavy. Business St.	Two	4	6	1.10 or over	Heavy tar oil	16	
37		Two	3½	5	1.12 or over	Heavy tar oil	20	
38	Heavy. Business St.	Two	4	6	1.10 or over	Heavy tar oil	16	
39	Heavy. Business St.	Two	4	6	1.10 or over	Heavy tar oil	16	
40	Heavy. Business St.	Two	3½	5	1.072	London distillate	20.3	Steam 6 hours; pressure 20 lb.; vacuum 2 to 4 hours, 22 in. Maximum oil pressure 110 to 135 lb.
41	Heavy. Business St.	Two	3½	5	1.053 at 38	English distillate	18.9	Steam 5 hours; pressure 20 lb.; vacuum 24 in. Maximum oil pressure 125 lb.
42	Heavy		3	4	1.03 to 1.08	Distillate oil	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
43	Heavy		3½	4	1.03 to 1.08	Distillate of coal, gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
44	Heavy		3	4	1.03 to 1.08	Distillate of coal gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
45	Moderate		3	4	1.03 to 1.08	Distillate of coal gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
46	Moderate		3	4	1.03 to 1.08	Distillate of coal gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
47	Heavy		3	4	1.03 to 1.08	Distillate of coal gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
48	Heavy		3	4	1.03 to 1.08	Distillate of coal gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
49	Heavy		3	4	1.03 to 1.08	Distillate of coal gas or coke oven tar	18	Steam 3 hours; pressure 20 lb.; vacuum 2 hours, 22 in.
50	Light. Business and Residence Sts.	One			1.14	Heavy tar oil	20	
51	Heavy. Residence St.	Two	3	6	1.05	Distillate	20	
52	Light. Residence St.	One	3	6	1.05	Distillate	14	
53	Light. Business St.		3	5	1.034 to 1.05	London distillate	20	Steam 3 hours; pressure 25 lb.; vacuum 1½ hours, 22 in. Maximum oil pressure 105 to 110 lb.
54	Light. Business St.	One	3	5	1.10 or over	Heavy tar oil	20	
55	Heavy	One	3½	5	1.03 to 1.08	English distillate	16	Steam 6 hours; pressure 22 lb. Final vacuum 2 hr., 22 to 25 in.
56	Heavy	Two	3½	5	1.03 to 1.08	English distillate	16	Steam 6 hours; pressure 22 lb. Final vacuum 2 hr., 22 to 25 in.
57	Heavy	Two	3½	5	1.03 to 1.08	English distillate	16	Steam 6 hours; pressure 22 lb. Final vacuum 2 hr., 22 to 25 in.
58	Heavy	Two	3½	5	1.03 to 1.08	English distillate	16	Steam 6 hours; pressure 22 lb. Final vacuum 2 hr., 22 to 25 in.
59	Heavy		3½	5	1.03 to 1.08	English distillate	16	Steam 6 hours; pressure 22 lb. Final vacuum 2 hr., 22 to 25 in.
60	Light		3¼	5	1.10 or over	Heavy tar oil	20	
61			3	5	1.12	Heavy tar oil		
62						Light distillate oil		

poor results were obtained with both light and heavy oils, and none of the trouble that has thus far occurred from expansion can in fairness be attributed to the kind of oil used.

It must readily be seen that, when a sand filler is used, water can penetrate the spaces between the blocks and be absorbed by the wood. This process can be retarded by creosoting the blocks, but not prevented, since creosoted wood readily absorbs water and as readily dries out. If the blocks are dry when laid and the sand filler is tightly packed, some form of buckling or expansion trouble is certain to occur during wet weather. During dry weather the blocks will dry out and shrink, the spaces betwen them will again become filled with tightly packed sand, and at the next rain further expansion trouble will occur. The result is that in time the courses will be forced out of alignment and, if there is not room for further expansion, there is the possibility of bulging, displacement of the curb and numerous other troubles. In order to prevent this it would seem absolutely essential to make the pavement waterproof.

Much less trouble was experienced with sand cushions, but sufficient could be traced to this method of construction to warrant the somewhat greater expense of the mortar cushion. This is particularly true where there are car tracks. Wherever there is considerable vibration, sand cushions are liable to shift, producing an uneven surface and permitting movement of the blocks. In case of a broken water main or excessively heavy rain, sand is liable to be washed from beneath the blocks and result in an entire displacement of the pavement.

An uneven surface was found in a few cases where the blocks were laid on sand cushion and filled with bituminous filler, but this could be traced to a shifting of the cushion due to vibration. In one case in Fort Worth, Tex., a water main broke and washed the sand from beneath the blocks, necessitating the relaying of a considerable area. A similar accident in a location where mortar cushion was used had no effect on the pavement. Furthermore, the mortar cushion does not become saturated with water as does the sand cushion, and it affords a firm foundation for the blocks.

On a number of streets having car tracks, the blocks were found to have bulged between rails, indicating that blocks laid along street railways should have ample provision for expansion and drainage, as conditions are more severe than on other sections of the pavement. Extra care should be used to see that they are not laid too tightly and that the surface is thoroughly sealed against the entrance of water. Much of the trouble noted was due to poor track construction, for it is practically impossible to lay a satisfactory wood block or any other form of pavement in street railway tracks of inferior construction.

While most of the streets inspected were from 25 to 50 ft. in width, some of the cities had streets 70 ft. wide. It is quite a problem to provide for expansion in such broad streets, and unless extra care is exercised, trouble is likely to develop. Several of the cities having a population of from 5000 to 15,000 had very broad streets. It is difficult to obtain satisfactory results with wood block paving on such wide streets, and the paved area should be reduced by some provision such as parking in the center.

It was found that the wood block pavements on streets with heavy traffic were less subject to expansion troubles than those in small cities or on light-traffic residence streets. For this reason it is not always safe to assume that the same allowance for expansion will be suitable for streets under different traffic conditions. Each case should be studied separately.

Machine Trenches 220 Feet an Hour in Shale

Solves the Labor Problem for Water Department of Erie, Penn., and Returns Half Its Cost on Four Miles of Mains

FOUR miles of 6- and 12-in. water-main trenches in wooded or frozen ground and with shale at the bottom were completed with a machine by the Water Department of Erie, Penn., between Feb. 1 and Oct. 5, 1917, at a cost far below that of hand work, even in 1915. Though at the speed developed by the machine, 3 to 3⅜ ft. per minute on 5½- and 6-ft. deep trenches, this represents less than two weeks' steady work, the difference in the amount paid for hand labor per foot in

SHALE THAT MACHINE CUT AT 3 FT. PER MINUTE

1916 and in the cost per foot of all labor and fuel required with the machine represents more than half the first cost of the tool saved on the four miles already completed. The saving is still greater, if the advance in wages since 1916 is considered, but in spite of it the increased labor cost of laying pipe and backfilling will make this year's work somewhat more expensive per foot than that done in 1915 or last year. Nevertheless, it is doubtful if the extensions built in 1917, representing more work than was done in either of the preceding years, could have been completed without the machine because of the scarcity of labor.

The trenching machine, a Pawling & Harnischfeger, bought early this year for $5650 f.o.b. Erie, is of the wheel type. The buckets are adjustable for cutting 11½

to 54 in. wide and trenches 4½ to 12 ft. deep can be dug. The machine is driven by a four-cylinder, four-cycle, 40-hp., gasoline engine. Ordinarily, one operator and one helper run it without other assistance under the supervision of the foreman who looks after the rest of the work. The trenches cut are 2 ft. in width and from 5½ to 6 ft. in depth. Clay 2 to 4 ft. deep, underlain by the shale shown in the photograph, is encountered on nearly all the work, though one trench has been dug in running gravel. Conditions are such that the machine cuts full length for the extension to be laid in a continuous operation, most of the trenches being less than 2000 ft. long. The pipe gang of seven men lays the new main behind it at the rate of a block, or 660 ft., a day. As the water mains are always extended in advance of paving, operations are completed by backfilling the trench with a team and scraper. In this manner 1½ miles of 12-in. and 2½ miles of 6-in. pipe were laid between Feb. 1 and Oct. 5 last.

During 1915, considered an ordinary year, the city laid 25,000 ft. of 6- and 12-in. mains in hand excavated trenches at a labor cost for digging, laying and backfilling of 28.8c. a foot for the smaller and 36.08c. a foot for the larger size. Much more pipe was laid in 1916 and this year because of the rapid growth of the city. While complete unit costs for the last year's work have not yet been compiled, it is known that rising wages caused considerable increase over those of 1915. Records for 10,000 ft. of 6-in. main laid at one time last year show a total labor cost of 37.1c. per foot, of which digging alone represented 19c. with common labor 27½c. an hour. The trench was in clay, with shale at the bottom. As compared with this, the first performance with the trenching machine, excavating for 1620 ft. of line, was accomplished at a fuel and labor cost of $132.84, or 8.2c. per foot for actual digging. This was in gravel which required sheeting, the cost of which is included in the above figure. On another occasion, in digging through cut-over land, where many large but partly rotted stumps were cut through, 682 ft. of trench was dug in four hours, at a cost of $7.55 for three men and 15 gal. of gasoline—only 1.1c. per foot. On Oct. 5 the machine made its speed record of 660 ft. in three hours, but $3.02 for gasoline and $1.88 for the wages of the engineer and helper being charged to the operation. This was about ¾ of a cent per foot. Both trenches were in shale at the bottom.

That these costs are typical of the work is shown by the record which the machine made on its most difficult bit of digging. Last winter, with 18 in. of ground frozen hard, it dug in one operation 7220 ft. of 2 x 5½-ft. trench at an average speed of 3 ft. per minute. But this is not all. The bottom of that trench was in shale, the average depth of which proved to be 44 in. Over most of the trench the clay was frozen to the top of the shale.

This shale is not laminated clay, but a true shale, which can be picked in excavating bell holes, but which it pays to shoot when any considerable yardage must be removed by hand.

The two miles of trench dug in these four operations are typical of the machine's work to date. It shows no appreciable wear, and maintenance on it has been negligible. The trenching in question, if done at the unit cost of the 2-mile trench dug by hand in 1916, would have represented a labor charge of $1935, whereas it actually cost, for labor and fuel, $200, fully half of which was chargeable to the sheeting required on the first gravel trench dug. This represents a saving of $1735. Doubling this for the four miles of main dug to Oct. 5, the machine appears to have saved $3470, or to have more than half paid for itself.

It is small wonder that E. W. Humphreys, superintendent of water-works at Erie, under whose direction all the work mentioned was carried out, considers a trenching machine a very good investment, aside from the fact that the labor shortage would have made it difficult to do anything this year without one.

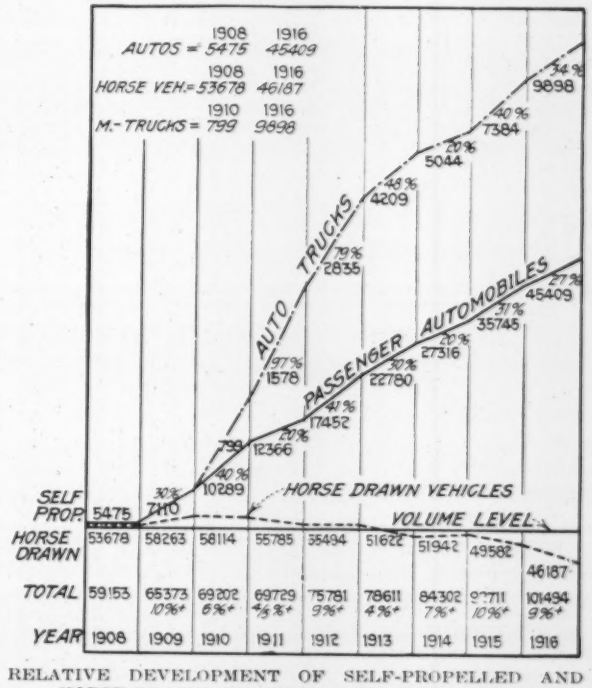
Chicago Motor Vehicles Increase but Horse Vehicles Decrease

TENFOLD increase of self-propelled vehicles in Chicago from 1908 to 1916 is shown by the city's records of licensed vehicles. This record also shows a net decline of 14 per cent. in the number of horse-drawn vehicles within the same period.

Self-propelled vehicles of all classes in 1908 numbered only 5475. In 1910, when the separate classification of automobiles and motor-trucks was commenced, the numbers were 10,289 and 799 respectively, or 11,088 in all. In 1916 there were 45,409 automobiles and 9898 motor-trucks, or a total of 55,307 self-propelled vehicles.

Horse-drawn vehicles numbered 53,678 in 1908 and increased to 58,263 in 1909. There has been a steady decrease to a total of 46,187 in 1916.

These developments in traffic conditions are shown graphically on the accompanying chart. This was prepared in connection with a recent traffic census, described in a paper read before the Western Society of Engineers by George C. D. Lenth, assistant chief engineer of sewers, Board of Local Improvements.



RELATIVE DEVELOPMENT OF SELF-PROPELLED AND HORSE-DRAWN TRAFFIC IN CHICAGO, 1908-16

Concrete Army Warehouses Built in Record Time

Low Structures of Large Area Expedited by Careful Arrangement of Building Processes and Design of Forms

By Edgar H. Mosher
Engineer and Contractor, Washington, D. C.

In the early months of the war the rapid construction of buildings became an immediate necessity. Most of such buildings were built of wood, but in some cases the authorities were persuaded that concrete could be built safely in just as short a time as the less durable constructions. One such building, completed in quick order by the writer's firm, is described in this article.

In the construction of these buildings—two two-story warehouses in Washington, D. C., for the War Department for use as a medical supply depot—the work was so laid out that the first structural slab was being concreted a few days after breaking ground, so that the speed of construction compared favorably with the possible speed in frame. The buildings being comparatively flat, two stories, 273 x 391 ft., it was possible to plan the work so that the construction progressed in a systematic manner from one end of the lot toward the other, and so that at any time the work stood in progressive steps toward one end of the lot but in the same relative condition of completion across the lot. That is, in the most advanced portion of the work the footings were being excavated across the full width of the lot; immediately behind this crew was another crew with a portable mixer placing concrete in the footings. Next came the crew setting column boxes, and then, in order, carpenters setting posts, carpenters placing stringers on top of the posts, others setting the flare tops of the columns, others the decking. Then followed the steel men and the concrete crew placing concrete in the columns and slab. Following the concrete gang by three days was the column stripping gang, then the crew stripping the bracing and part of the posts, then the steel sash, door and partition men, then the cement finishers placing sills and windows, then the main stripping crew 14 days behind the concrete men, and finally a few men cleaning up in conjunction with the roofers and skylight men.

In this way there was a steady daily progress of at least two complete panels across the entire width of the building. Each crew had a fixed amount of work which must be completed by night and there was the keenest rivalry between the different crews to tread on the heels of the crew ahead. The result was that the entire organization was easily kept tuned up to concert pitch, and each man became very expert at his particular part of the work.

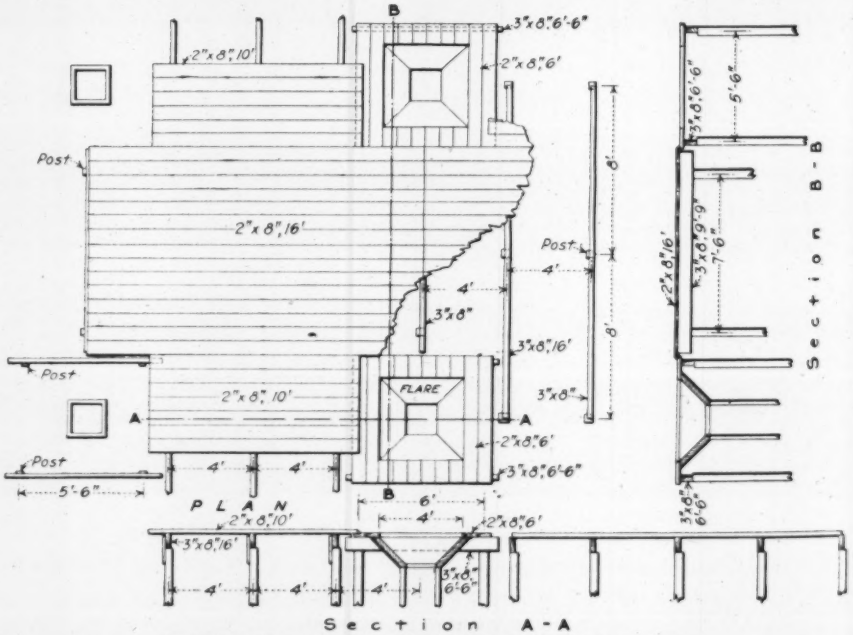
Negotiations for the building were started on May 17. Actual field concrete work was not begun until June 8, the intervening time being consumed in drawing and redrawing plans and specifications to meet the approval of all departments concerned, arranging for the lot, getting permits and purchasing and assembling the plant and equipment on the job.

The work was started on June 8, on July 13 the roof of one building was poured and on July 30 the War Department began to take possession, although the builders had not contracted to deliver the building until Aug. 23. Thus the building was occupied 52 calendar days after starting work and 74 calendar days after the conception of the operation.

There is in excess of 192,000 sq.ft. of net floor space in these buildings, so that the speed of construction compares favorably with that of temporary frame structures, and the surprisingly slight difference in cost is more than justified by the safety and the freedom from repairs. The cost per square foot of floor was less than $1.25 including heating, lighting, plumbing and railway siding.

The building was designed by the same organization by which it was built, so that the benefit of all time-saving features of design was enjoyed, through the co-operation of the designing engineers with the field forces. This resulted in getting the work planned and under construction in a remarkably short time after the conception of the operation.

The building is reinforced concrete throughout, including all exterior walls, which are 8 in. thick and reinforced against contraction. No precautionary measures in the way of waterproofing were taken other than the careful mixing and placing of the concrete. The concrete roof as constructed was water-tight and, al-



TYPICAL PANEL OF FORMS FOR FLAT-SLAB FLOOR

though a large number of such roofs have been constructed by these contractors and others without waterproofing or patent roofing of any kind, still an additional tar and gravel roof was added because of the size of the roof and the danger from shrinkage cracks in the shade of the stack and projecting skylights.

The floors are four-way flat-slab construction with drop panels except in the roof. Heavy radial and circumferential reinforcing in addition to the local requirements was added over the column tops so as to bring the point of inflection farther out and increase the resistance to shock in case of an emergency overload. The floors were designed for live loads of 300 and 600 lb. per sq.ft. Unusually severe conditions had to be provided for in the floors, since there was to be a continuous parade of overloaded motor trucks and steel-tired wagons over all floors from morning till night. To reduce the wear and the chipping action of the calks on the horses' hoofs the floors were surfaced with a rich mix and were treated with Lapidolith floor hardener.

The ground floor is placed partly on cut and partly on filled ground and is reinforced, to bridge over any possible soft spots. No expansion joints or slab markings are used anywhere in the building, and so far there has been nothing to indicate the necessity for such joint where a building is properly reinforced.

The edge of the roof slab is hung on beams projecting above the roof, so that the steel sash extend to the full height, giving an unobstructed ceiling from wall to wall. This also greatly simplified the roof forming. Sufficient clearance was allowed under the slabs and in the doors for the highest army wagon that is used.

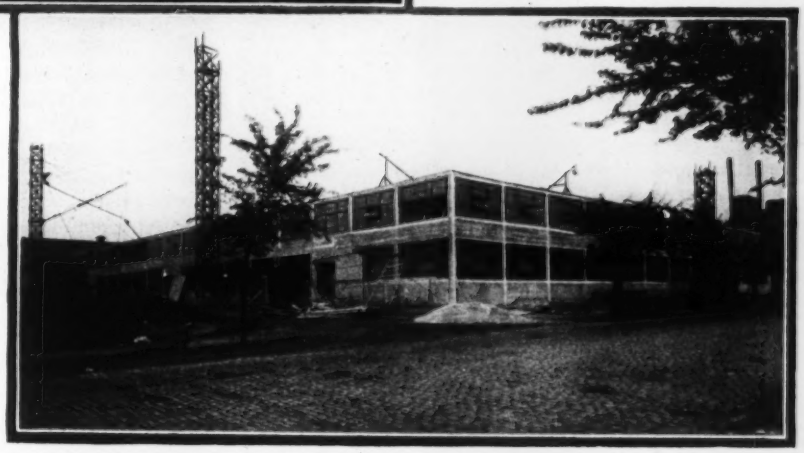
Heretofore, the construction company has used steel forms almost exclusively, but because of the impossibility of obtaining steel plates in sufficient time, the same general methods of forming were worked out in wood and proved to be very successful.

Two-inch dressed lumber was used for the decking and was cut to four standard lengths as follows: (1) Panel length, (2) length equal to the distance from edge to edge of drop panels, (3) length equal to width of drop, (4) length equal to the distance from the edge of the drop panels to the wall beams.

The planking was thus fitted in without cutting and with very little nailing, as shown in the sketch. The joists were 3 x 8 in., cut mostly to panel length, except that one joist per panel was cut to a length equal to the distance from edge to edge of drop. The lumber was oiled and cleaned, and in this way the loss was very small, being confined almost entirely to the posts and bracing. The columns and beams were made in the usual way in panels and were fastened with Universal clamps. The square flare tops were spiked together with special washers under the heads of the spikes to facilitate stripping.

The entire plant was purchased new to insure relia-

EARLY IN JUNE HOLES WERE DUG FOR COLUMN FOOTINGS OVER ENTIRE SITE OF REINFORCED CONCRETE WAREHOUSE WANTED ON RUSH ORDER FOR MEDICAL SUPPLIES FOR WAR DEPARTMENT



TOWARD THE END OF JULY, SIX WEEKS AFTER WORK ON THE MEDICAL SUPPLY WAREHOUSE HAD STARTED, THE TWO-STORY REINFORCED CONCRETE BUILDING COVERING NEARLY THREE ACRES WAS ABOUT COMPLETE

bility and freedom from breakdowns and was designed and rigged according to the standards of the construction company. The booms and spouts were rigged with fixed lengths of cables and large hooks for connections, so that no adjustment or fitting of any kind was required in rigging. The boom, boom seat, hopper and spouts are raised by power and dropped into hooks in their correct positions without adjustment or measuring. In this way the plant can be dismantled, moved and re-erected in a remarkably short time.

The reach of the boom with one additional length of spout was such that almost no wheeling of concrete was required. Four 100-ft. towers with 18 cu.ft. Insley roller buckets and 50-ft. booms were used in six different locations with two ½-yd. Ransome mixers. Thus the towers could be erected in the desired location in advance of the concreting requirements, and the only shutdown was in moving the mixers. By planning the work in advance so as to take advantage of a comparatively slack day and moving one mixer at a time, it was possible to concrete immediately behind the carpenters every day. This was absolutely necessary since the work was so balanced that a delay in concreting and therefore in stripping meant either a delay to the carpenters or the necessity for the purchase of two entire sections of form lumber.

Although this method of handling the concrete plant involved more moving than a central plant would have required, it was found that this was more than offset by the great flexibility and the saving in rigging long lines of guy-line spouts.

Cement was delivered in cloth sacks by motor truck from a convenient storage warehouse on a siding. The sand and gravel were brought from the wharves as needed by means of motor trucks, and were dumped at the required points. Because of the semi-portable nature of the plants no storage bins or mechanical handling machinery was used other than the standard pivot hoppers on the mixers. An additional small mixer, a Ransome Bantam, was used for small work, such as mixing topping and mixing concrete for footings inaccessible from the larger plants.

This work was done by the E. H. Mosher Co., of Washington.

Akron Used Salt for Ice Removal

Salt was used on a large scale to remove ice from sidewalks and street intersections at Akron, Ohio, in January, according to H. S. Morse, the new director of public service. For a week after a freezing rain the sidewalks were dangerously slippery. "Finally," writes Mr. Morse to *Engineering News-Record*, "the city bought several tons of an inferior grade of salt and sprinkled it on the sidewalks and some of the streets at street intersections. We offered this salt for sale to citizens, 25 lb. for 10c., and made a store-to-store canvass of the downtown district, urging the retail merchants to put salt on their sidewalks. If they had no other means of obtaining it, they were advised they could get it at the City Hall at the price above mentioned. Coöperation was general, and the merchants either procured their own salt or bought some from the city, and improved the city's sidewalk conditions materially."

Inspection Cost an Index of the Contractor's Ability

Study of Paving Jobs During Past Three Years Shows Character of Work May Be Judged in This Manner

By H. W. Skidmore
Construction Engineer, Dept. of Public Works, Oak Park, Ill.

NO DOUBT a great many engineers know that some relation exists between the cost of inspection and the character of the work done by contractors. How many of the profession have defined this relation through a comparison of facts and figures, and what percentage have merely been aware, in a vague sort of way, that it exists, I cannot say. Neither would I attempt to say to what extent such definite information may be valuable to engineers in general. At least it must be conceded that it is valuable for the revealing light it casts upon a year's work, or the work done through successive years; and for the purpose of planning the direction of field work in the future.

In the accompanying summary under asphaltic pavements, contractor "A" cost us considerably more for inspection than did any of the others doing this class of work during the past three years. While owing to extraordinarily close inspection, there has been a decided improvement in the grade of work done by this particular contractor, yet, judged from every angle, the work in many ways is noticeably inferior to that done by the other firms. The difference in smoothness of surface is so apparent that it is at once noticed on riding over the streets.

Firm "A" is notorious for its poor management and organization; and, owing to personal peculiarities of its directing head, it seems unable to retain competent foremen and labor for any length of time. Good men will not work long for a contractor who interferes to such an extent that the organization is in a constant state of disruption and uncertainty. "A" belongs to the type of contractor that always takes a contrary stand in every issue and persistently resorts to small, nasty deviations from specifications and instructions issued by the engineers and inspectors—that always knows a better way of doing things and goes ahead and does them without those in authority. In short, a continual battle is in progress

DATA COMPLETELY 1915

Contractor	Sq.Yd. Laid	Cost of Labor and Material	Inspection Cost Amount	Inspection Cost % L. & M.	Inspection Cost Per Yd.
A	15,157	$33,762.10	$896.32	2.65	0.059
B	22,428	42,066.01	573.80	1.36	0.026
C	23,779	45,364.45	568.82	1.25	0.024
D	.....	.....	.....	.....	.....
Totals and averages	61,364	$121,192.50	$2,038.94	1.68	0.033
BRICK—in 1917—All Semi-Monolithic Type					
A	.....	.....	.....	.....	.....
E	8,317	$22,612.91	$170.18	0.75	0.02
F	13,215	36,137.43	458.18	1.27	0.035
G	8,205	24,661.50	257.32	1.04	0.031
Totals and averages	35,133	$98,452.43	$1,225.93	1.25	0.035
CONCRETE—Alleys					
H	912	$1,488.96	$42.00	2.82	0.046
A	.....	.....	.....	.....	.....
I	.....	.....	.....	.....	.....
J	.....	.....	.....	.....	.....
Totals and averages	912	1,488.96	42.00	2.82	0.046
Grand totals and aver's	97,409	$221,133.95	$3,306.87	1.50	0.034

from the beginning of the job until the final measuring is done.

For the most part, the "troubles" experienced with a contractor of this type are "little things," no one of which is usually serious enough to warrant closing down the work, but in the aggregate they make it necessary to resort to unusual efforts and extraordinary care to secure absolute compliance with specifications and instructions. In consequence of this, and because the lack of efficient management results in slow progress, the inspection cost is naturally high, if even a fair grade of work is obtained.

Contractors "B" and "C" are long-established firms with highly developed organizations, who begin a job, see it through, and turn out first-class work in record time. They are reasonable and gentlemanly in their dealings at all times. Every engineer must have experienced the feeling of relief that is the result of passing from a job in the hands of a contractor of "A's" characteristics to one of "B's" or "C's".

Contractor "D" is a newly established concern not yet completely organized, but doing first-class work. While it requires more time to complete a given job than do "B" and "C", still "D's" average unit rate is considerably under "A's". This has been particularly true during the season just past, since "D" was doing a great deal of work in other localities. This, together with poor labor conditions, retarded his work in Oak Park.

And so the rule continues to work out for other types of pavement, as well as for sewer and water-supply work.

The "sizing-up" of each contractor's work includes, besides observation in the field, a thorough analysis of the inspectors' reports, which are uniform and cover every important detail of the work. The character of work is judged on the same basis, which is about as follows:

(1) Final results, or how nearly each job approaches thorough compliance with the specifications.

(2) The same test as in (1) applied to each stage of the work, such as grading, base, etc.

(3) Difficulties encountered by engineers and inspectors in obtaining the desired results; such as promptness in following instructions, reasonableness in interpreting specifications, etc.

(4) Class of men employed, their competence and familiarity with the work.

(5) How the men feel toward their employer—in other words, the contractor's treatment of his men.

(6) General efficiency of the contractor's organization and management.

(7) Delays in the progress of the work, and whether or not the contractor is responsible for them.

(8) Amount of maintenance required during the five-year guarantee period, and how much of the same may be directly attributed to defective work.

Averages covering a number of jobs must be used, in justice to the contractors, and the longer the period and the larger the number of jobs, the greater will be the degree of accuracy in his rating Isolated, individual jobs cannot safely be used to establish the rule, for local conditions for which the contractor is not responsible might be of such nature as to cause either an unusually high or low rate.

Judged according to every reasonable standard, the work done by various contractors during the past four years has borne out my contention that those contractors whose work required the highest unit inspection costs invariably did a poorer grade of work than those who, by good management, completed their work in record time and thereby minimized such costs.

Record Made in Producing Timbers for Ships

Southern pine manufacturers "went over the top" in a recent week in the production of ship timbers for the Government's wooden fleet, according to figures compiled at the offices of the Southern Pine Emergency Bureau. In spite of extremely cold weather and other operating difficulties, mills shipped during the six-day period 85 cars of ship timbers a day, or a total of 510 cars for the week. These cars loaded on an average of 16,600 ft. each, which made the shipments 1,411,000 ft. a day, or nearly enough to complete a standard-size 3600-ton Government wooden ship every day. The total shipments for the week aggregated 8,466,000 feet.

This is the best record yet made by mills in promptly furnishing ship materials.

At the present rate of shipments Southern pine producers will have delivered by the end of March all the timbers they have contracted to furnish the Government up to July 30.

SUBSTANTIATES BROAD STATEMENT OF VALUE OF INSPECTION COSTS

1916					1917					Totals and Averages				
Sq.Yd. Laid	Cost of Labor and Mazerial	Inspection Cost Amount	% L.&M.	Per Yd.	Sq.Yd. Laid	Cost of Labor and Material	Inspection Cost Amount	% L.&M.	Per Yd.	Sq.Yd. Laid	Cost of Labor and Material	Inspection Cost Amount	% L. & M.	Per Yd.
67,034	$152,911.37	$3,806.00	2.49	0.057	21,111	$55,846.07	$1,197.32	2.14	0.057	103,302	$242,519.54	$5,899.64	2.43	0.057
20,357	45,097.83	647.76	1.44	0.032						42,785	87,163.84	1,221.56	1.40	0.028
32,061	67,781.28	1,209.38	1.78	0.038	7,717	14,611.17	232.20	1.59	0.030	63,557	127,756.90	2,010.40	1.58	0.032
68,516	157,759.05	3,020.17	1.91	0.044	18,191	42,878.85	1,113.20	2.59	0.061	86,707	200,637.90	4,133.37	2.06	0.048
187,968	$423,549.53	$8,683.31	2.05	0.046	47,019	$113,336.09	$2,542.72	2.24	0.054	296,351	$658,078.18	$13,264.97	2.01	0.045
.....	.....	.....	.....	.....	1,642	$5,057.52	$180.16	3.00	0.115	1,642	$6,057.52	$180.16	3.00	0.115
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,317	22,612.91	170.18	0.75	0.02
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,215	36,137.43	458.18	1.27	0.035
.....	.....	.....	.....	.....	6,979	24,936.91	497.85	2.00	0.07	15,184	49,598.41	755.17	1.52	0.05
.....	.....	.....	.....	.....	8,621	$30,994.43	$678.01	2.19	0.08	43,754	$129,446.86	$1,903.94	1.475	0.044
.....	.....	.....	.....	.....	1,323	$3,152.00	$130.56	4.15	0.099	2,235	$4,640.96	$172.56	3.72	0.077
2,841	$5,441.14	$286.13	5.27	0.106	6,067	11,760.99	476.00	4.05	0.079	8,908	17,202.13	762.21	4.49	0.087
1,068	1,524.96	36.00	2.36	0.034	.....	.....	.....	.....	.....	1,068	1,524.96	36.00	2.36	0.034
780	1,400.00	16.00	1.14	0.021	.....	.....	.....	.....	.....	780	1,400.00	16.00	1.14	0.021
4,689	8,366.10	338.13	4.05	0.074	7,390	14,912.99	606.64	4.07	0.082	12,991	24,768.05	986.77	3.99	0.076
192,657	$431,915.63	9,021.44	2.09	0.047	63,030	$159,243.51	$3,827.37	2.40	0.061	353,096	$812,293.09	$16,155.68	1.99	0.046

Crisis in the Harrisburg Water Department and Its Cause

Water Famine in Cold Spell Due to Breakdown of Half-Century Old Duplicate Pump and Political Maladministration

Special Correspondence

THE municipal water-works system of Harrisburg, Penn., a city of nearly 75,000 population, broke down in January, 1918. The distributing reservoir was emptied and every industry was shut down from Jan. 23 to 29, while in some parts of the city there was no water for household use or fire protection. The cause of this shortage was the lack of duplicate pumping equipment of sufficient capacity to handle the cold weather water demand. Although the consumption is 80% metered, the extremely cold weather increased the pumpage from 8,000,000 to 10,000,000 gal. a day, so the 20,000,000-gal. distributing reservoir was practically emptied in a few days.

The situation was relieved in the following manner: 1. The city commissioner in charge of the water-works called in a citizens' committee of five to assist him. 2. This committee immediately ordered all industries closed down until further notice. 3. It then arranged for the delivery into the city mains of 2,000,000 gal. of water a day from a private water company to the north, and of 500,000 gal. a day from the Borough of Steelton on the south. 4. It issued directions concerning water waste and asked the mayor to issue a decree prohibiting waste, particularly against leaving faucets open at night. 5. It facilitated shipment of an electrically-driven centrifugal pump and its installation as a temporary expedient. In six days after this committee got to work the reservoir was full and industries had resumed operations.

All this trouble was brought about because the water department had but one pump of sufficient capacity to supply the maximum needs of the city. This pump broke down in November, 1917, and had not been repaired by the latter part of January. In the meantime the pumping was being done by an old engine 45 years in service. This unit after operating about two months finally broke down in the middle of the night (Jan. 25) and before it was repaired the reservoir was practically empty.

The fundamental cause of the Harrisburg situation is believed to be as follows: With the old form of city government, a water commission of three unpaid business men directed the operation of the water-works and employed an experienced man at a fair salary as general superintendent. He knew the needs of the plant and kept abreast and ahead of the requirements to a considerable extent. A few years ago the commission form of government was instituted in Harrisburg and to one of the five commissioners was delegated the duty of managing the water-works. He has no superintendent and attempts to handle the duties himself. Since this form of operation has been in effect the water rates have been reduced twice, it is said for political effect, and maintenance and improvement of the plant have suffered.

The water department has felt safe for years because there was an auxiliary pump of a capacity of about the normal water consumption, and as long as there was no need to use it, this unit seemed a reliable resource in case of need. But when the time came to use it the consumption increased beyond normal and the capacity of this reserve unit was too small, while the storage in the distributing reservoir, only 2½ days supply, was also inadequate to tide over a long-continued period of excessive demand.

A mechanical-filtration plant was installed in 1905 and has a capacity nearly 100% in excess of present normal consumption. The low-lift pumping equipment, which lifts the Susquehanna River water to the filters, consists of two pumping units, each of twice the daily normal consumption. Thus, although it was possible to filter water in excess of maximum requirements, the high-lift pumps, which lift the filtered water to the distributing reservoir, could not take the filtered water away from the filters as fast as required.

Under the old regime, politics interfered considerably less in the operation of the water department than under the new order of things, where the man at the head of the department is a member of the board of five city commissioners and is elected by the people. To the mind of the average city commissioner nothing could apparently do more to insure his reëlection than a reduction in the water rates. This could not be accomplished if new pumps had to be installed out of revenues or if the reservoir was enlarged.

Now that the need has been shown for large expenditures for improvements, the city commission proposes an immediate raise in rates. This was to be done in a haphazard, arbitrary way, without reference to the value of property, or to the cost of operation or maintenance, but the city officials have been convinced of the necessity for setting the rates in a scientific manner. The Harrisburg water department is run as are many other municipal plants, by paying for many improvements and all extensions out of revenue. Water is furnished to other city departments free and to many churches and hospitals.

The crisis in the water-supply of Harrisburg, which had affected nearly every citizen, city official and industry, has brought home the necessity of having a trained man in charge of the water-works who is not affected by political considerations and who can foresee the needs of the plant and prepare for them before the urgency arises.

Iron Ore Production Increased in 1917

Figures collected by the U. S. Geological Survey show that the iron mines of the country produced practically the same amount as in 1916; namely, about 76,000,000 gross tons. The value of the output, however, was over $236,000,000, as compared with $182,000,000, making the average value of the ore per ton at the mine $3.12, as compared with $2.34 in 1916.

About 85% of the ore mined came from the Lake Superior district, all but 2,000,000 tons of this being shipped by water. About 8,000,000 tons were produced in the South, 80% of this coming from the Birmingham district; 2,500,000 tons were produced in New Jersey, New York and Pennsylvania, and minor amounts in other states.

Ordnance Factory 710 x 140 Feet Built in Three Months

Schedule Met on Large Plant at East Moline, Illinois, Despite Difficult Concrete Work and Bad Weather

By Harold Greenleaf

Engineer, Henry W. Horst Company, General Contractors, Rock Island, Ill.

An ordnance and munitions factory in East Moline, Ill., which required a large amount of concrete floor and footing work and the erection of much timber framework with a derrick, was recently completed in less than three months for the Root & Van Dervoort Engineering Co. The building occupies a plot of ground 710 x 140 ft. and consists of four bays extending the full length. These are a balcony bay comprising, in addition to the main floor, a second floor on which it is proposed to employ the services of women; a monitor bay in which travel two 5-ton trains and two saw-tooth bays.

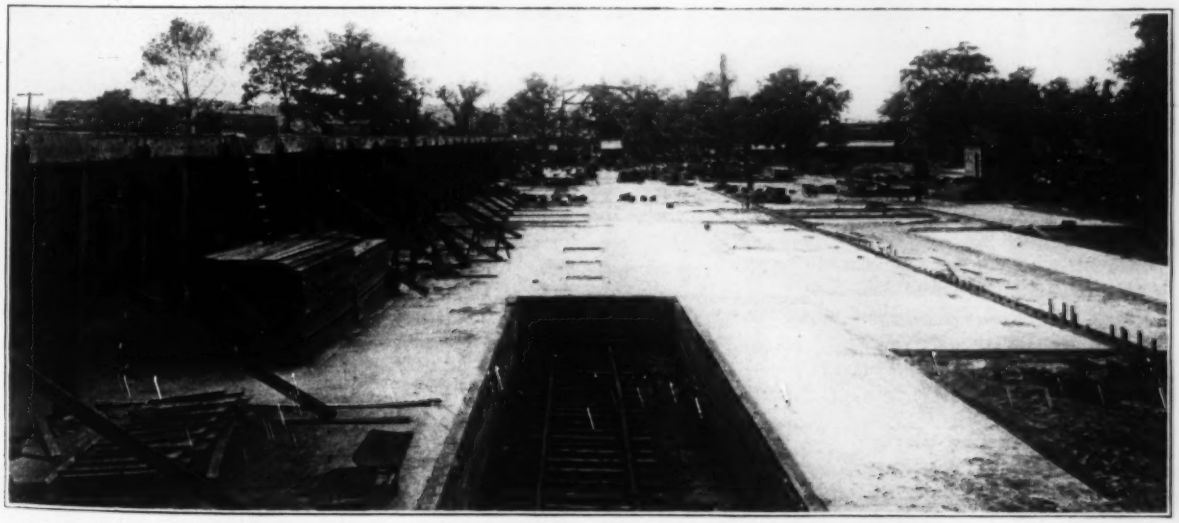
The contract was signed late in the afternoon, and the following morning the contractors had a force of men clearing the site, which was covered with oak trees of small growth. During the first ten days work was much delayed because of unusual wet weather, which hampered the progress of grading and trench excavation. Apart from this difficulty, however, the work progressed according to schedule.

The exterior walls are carried on concrete footings which extend about 4 ft. below grade. At the extreme northeast corner, however, on account of low and swampy ground, it was found economical to employ caissons carried to a solid bearing. These are connected by reinforced-concrete beams which serve as wall foundations. Concrete piers support the interior columns, the footings in some cases being extended in solid rock, which lay from 4 to 6 ft. below grade. The exterior walls are of brick. The north end of the building, however, was closed with a temporary wall of prepared roofing to allow for a future extension in that direction. The interior of the building is entirely of mill construction.

Construction material was received at the site on cars, an unloading track extending the entire length on the south. Two steam concrete mixers were employed, one located at the west end of the building and the other about midway of the south side. The first was used to concrete a little more than one-third of the floor area and foundations, material being delivered by motor truck for this part of the work. The remaining two-thirds of the concrete yardage were placed by the second mixer, material being unloaded from railroad cars within easy wheeling distance. All the concrete was wheeled to place in buggies, this method being considered more economical under the circumstances than a spouting plant.

For erecting the roof trusses an A-frame derrick with a 75-ft. boom, operated by an electric hoist, was employed. The derrick was mounted on dollies. It was set in the center of the monitor bay, from which position all floor trusses across the building could be reached. As erection progressed the derrick was moved along on rails which afterward were used for the crane runways. This part of the work was done with unusual speed, and served to increase progress on the entire job, as the masons were being continually crowded by the erecting gang and the carpenters were obliged to keep the latter supplied with trusses. It should be stated that none of the trades failed in their part of the work. An average of 32 trusses per day were erected, this number covering four 16-ft. bays. When the derrick reached the rail pit at the end of the building it was set on a flat car which was moved on as erection proceeded. When setting the last trusses the derrick was some 50 or 60 ft. outside the building, the ends of the A-frame being supported on cribbing.

Following the erection crew was a gang putting on roof sheeting, which in turn was closely followed by the roofers, so that by the time the last trusses were set the building was practically under cover. Some 1500 wood sashes were used, those in the main walls



FLOOR AND FOOTING CONCRETE WERE WHEELED TO PLACE IN BUGGIES BECAUSE OF LARGE AREA COVERED

DERRICK SET TRUSSES CLEAR ACROSS BUILDING FROM ONE POSITION

being double-hung, while of the remainder, those in the south tube and monitor trusses, every fourth sash was top hinged and operated. All sash in the south tube and monitor bays were trimmed to a prescribed width at the mill so that no dressing on the job was necessary in fitting them.

A soaking pit in the building, 40 x 10 ft. and 17 ft. deep, offered some difficulties because about 10 or 12 ft. of the excavation was through rock. This was not commenced until after the building had been practically completed, and it was at first believed to involve too much risk to attempt blasting. Two of the main column piers were directly alongside the pit. However, it was later discovered after trying this method with light charges and a blanket of railroad ties and old tarpaulins, that it was possible to prevent any rock being thrown out of the pit. The adjacent piers were in no wise disturbed by the blasting.

The entire contract was to be completed in 71 working days. With the exception of a week's extension granted by the owners due to adverse water conditions encountered early in the job, the work was completed well within the prescribed time. It was carried out by the Henry W. Horst Company, of Rock Island, Ill., under the direct supervision of A. Horst, who made his headquarters on the job. J. H. Wood was carpenter foreman and Kurt Lundeen assistant superintendent and engineer up to the time of his enlistment in the Federal service, his place being taken by the writer.

Gallery Range for Service Rifle Built at Camp

National Army Engineer Regiment Builds Safe and Successful Underground Range for Regular Target Practice

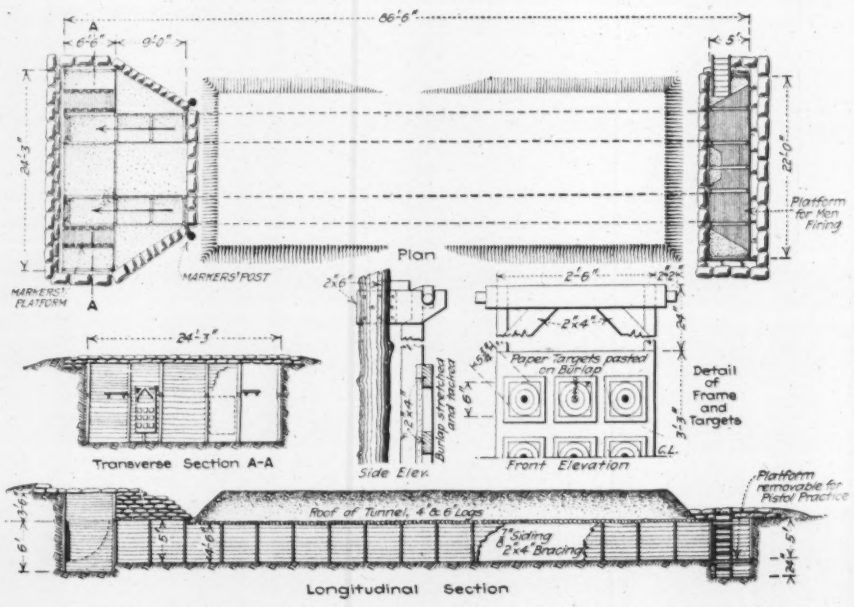
AN UNDERGROUND target range for practice with the service rifle has been built by the 302d Engineers at Camp Upton, Yaphank, N. Y., for the use of the men in training there. A description and drawing of the range have been supplied by Col. C. O. Sherrill, in command of the regiment.

The range possesses certain advantages which will recommend it, according to circumstances, either to military organizations or civilian rifle clubs. It is cheap to construct and requires but little space, and it is safe to use with the service rifle and service ammunition, even in a thickly populated district. The use of the service rifle gives it a great advantage over the ordinary gallery range for those who wish to learn military shooting. For the beginner practice on this range can be made as instructive as practice on the regular army ranges.

The firing is done in an open pit, whence the bullets pass through a covered trench to the targets, these being located in another open pit. The length of the range is 75 ft., and the targets are of suitable size to simulate the 200 yd. range of the regular course.

The reasons for some parts of the design will be evident from the following description:

Taking position in the place indicated, the men ordinarily fire from the prone position. There is one scorer for each firing point, who stands on the bank just be-



ENGINEERS IN NEW ARMY BUILT THIS UNDERGROUND RIFLE RANGE

hind the firer. The target man, or marker, stands at the point indicated, where he can see the bullet holes, and after each shot he calls out the value of the hit to the scorer, who writes the score on the score-card which is kept for each man. The location of the hit is indicated by the clock designation; a twelve o'clock four is in the four ring and directly above the bull's-eye; a three o'clock three is in the three ring and to the right of the bull's-eye, and so on.

Each man fires five shots. When nine men have fired, the target frame with nine targets is removed and another frame is put in its place, which can be done very quickly. New targets are then pasted on the frame which was removed.

The principal safety precaution is to allow no one to go inside the line of sandbags around the targets without first obtaining permission from the officer supervising the firing and after the command is given to cease firing and rifles are unloaded. The target man also places a red flag in the gallery while he is in the danger space.

By removing the platform for men firing, and using suitable targets, the range can be used for pistol practice.

The range was designed by Lt. Col. C. R. Pettis, assisted by officers of the 302d Engineers. It was built by the men of the regiment under direction of Colonel Sherrill.

Recovery of Grease and Fertilizers from Sewage Comes to the Front

Massachusetts Joint Investigating Board Reports Against Applying Miles Acid Process at Boston —Federal Test of Process on Large Working Scale as a War Measure Sought

THE Miles acid process of treating sewage has recently come to the front at Boston and Washington. Coincidently with an adverse report on applying the process to Boston sewage, made Jan. 1 by a joint investigating committee created by the Massachusetts legislature of 1917, various private and public interests centering in the Boston metropolitan district made a hard drive to get the process taken up by the Federal Government. The scheme first proposed, according to a lengthy Washington dispatch to the Boston *Transcript* dated Jan. 8, was to secure $1,000,000 or $2,000,000 from available funds or from Congress to treat the 100,000,000 gal. of sewage discharged into Boston harbor daily at Moon Island from one of the three main outlets of the metropolitan sewerage system. During the latter part of January a series of conferences was held at Washington between various parties from Boston and vicinity and federal officials connected with the Food Administration, the War and Agricultural Departments, the Public Health Service and the Council of National Defense. All present seem to have been convinced that the process ought to be tried on a large working scale because it may prove to be a means of recovering vast quantities of fatty and fertilizing materials from the sewage of at least the larger cities of the country at a time when needed as never before. Desirable as government aid would be, it appears to have been decided that there was no warrant in spending Federal money on a plant treating the sewage of a single city, but that perhaps the process could be applied at one of the army cantonments which is said to need sewage-treatment works. A formal proposition to that end will be made to the War Department by the promoters who, it is reported, have already offered to grant the government a license at $1 a year for the period of the war.

The Miles acid process of sewage treatment was devised and has been patented by George W. Miles, a Boston chemist. It was tried experimentally in 1911-14 at the Calf Pasture sewage pumping station on the line of the Moon Island outlet of the Boston main drainage system by Mr. Miles and E. S. Dorr (Mr. Dorr was then engineer and recently has been office engineer of sewers, Boston). In 1916 the process was further tried on Boston sewage at the Sanitary Research Laboratory of the Massachusetts Institute of Technology, under the direction of Robert Spurr Weston, consulting engineer, and assistant professor of public health engineering at the Institute. (A paper on the earlier half of Mr. Weston's experiments appeared in the *Journal* of the American Public Health Association for April, 1916, and was abstracted in *Engineering News-Record* for May 11, 1916, p. 913. See also letter of comment, with epitome of European experience, by Kenneth Allen, *Engineering News-Record*, May 25, 1916, p. 1005. A small pamphlet, in which Mr. Weston reviewed the experiments for the full year, has been reprinted from the Boston *City Record*, March 3, 1917.)

According to Mr. Weston's pamphlet: "The Miles process attempts, by the addition of an acid to precipitate the bulk of the solids from sewage in the form of a sludge which can be dried and degreased, thereby producing a readily salable and greaseless fertilizer, as well as recovering the valuable grease. Either sulphuric or sulphurous acid may be used, and the process contemplates the manufacture of the acid at the disposal works."

After considering both Mr. Dorr's and his own experimental data Mr. Weston concluded his pamphlet by giving an estimate of $18 per 1,000,000 gal. as the cost of treating Boston (Moon Island outlet) sewage and $6 as the margin of profit. He added that "the large size of the Moon Island plant and the tanks already in existence there are all in favor of a reduced rather than an increased cost of treatment" and recommended that the city of Boston make "an experiment on a large scale to settle all question of doubt."

Since the Miles-Dorr and the Weston tests, Mr. Weston writes to *Engineering News-Record* under date of Jan. 24, grease has gone up to 20c. a pound and

fertilizer ammonia to $6.50 a unit, while "the cost of acid treatment has not been correspondingly great, so that it now appears that the value of Boston sewage is not far from $100 and the cost of acid treatment not far from $20, leaving a balance of $80 for dewatering, drying and degreasing approximately 1900 lb. of sludge per 1,000,000 gallons."

From the city sewage experiment station at New Haven, Prof. C-E. A. Winslow, reports that eight months tests of the Miles process "have substantially corroborated Weston's earlier experiments so far as the technical end goes. We have to use somewhat more acid than he used in Boston, but we get a satisfactory disinfection of the effluent and a sludge that is very rich in grease" and of "high stability."

Joint Investigating Board Created

Reverting now to the report of the joint investigating board mentioned in the opening paragraph of this article, it may be noted that about the time Mr. Weston's pamphlet report on his 1916 experiment appeared the Association of Municipal Improvement Societies of the Boston metropolitan district and some of the citizens of Quincy, Mass., became interested in the Miles process. The latter claimed that their shore was polluted from the Nut Island or south metropolitan sewer outlet, and perhaps from the Moon Island outlet, and urged that the Moon Island sewage discharge was disagreeable to sail through in the summer. An investigation of both harbor pollution and recovery of merchantable wastes was ordered by the state legislature and $5000 appropriated for the work. A joint investigating board was created, composed of Dr. Henry P. Walcott, chairman Metropolitan Water and Sewage Board, Dr. A. J. McLaughlin, commissioner of health of Massachusetts, and Edward F. Murphy, commissioner of public works of Boston. Its brief report is dated Jan. 9, 1918, and is supplemented by a detailed report by X. H. Goodnough, chief engineer, and Harry W. Clark, chemist, of the Massachusetts state department of health. F. D. Smith, chief engineer of the metropolitan sewerage works, also assisted the joint board in its studies. As is stated in more detail further on, the board concluded that remedial works against harbor pollution are not necessary and that in the light of foreign experience and of analytical data based on Boston sewage, and taking into account the fact that the far richer wool-scouring wastes at Lawrence, Mass., almost go a-begging for utilization, the expenditure of money for the recovery of marketable wastes from the district sewage would be unwarranted until large-scale experiments had demonstrated the commercial practicability of the scheme.

Studies of Metropolitan Sewage

The population in the 24 cities and towns connected with the Metropolitan sewerage district in 1915 totalled 1,421,000. The sewage from these municipalities discharges through three main outlets into Boston Harbor, which has a water area of 43 square miles, excluding tidal estuaries. The total amount of sewage discharged through these outlets averaged 214,000,000 gal. a day in 1915 and 221,000,000 in 1916.

None of the sewage is treated except for incidental sedimentation in the case of the Boston main drainage district before discharge at the Moon Island outlet. This district and a tributary population of 381,322 in 1915, and an average daily sewage discharge of 101,000,000 gal. in 1915 and 93,000,000 gal. in 1916. The maximum discharge each year was nearly double the average. The sewage from the Boston main drainage system is pumped at the Calf Pasture station to deposite sewers; flows thence through the Dorchester Bay tunnels to storage reservoirs on Moon Island having a total capacity of 50,000,000 gal.; and is discharged in the second and third hours of the outgoing tide.

Summarizing, the joint investigating board states that because of the detention of this sewage "it becomes much decomposed and putrefied and its odor is more offensive than that of fresh sewage." In calm days the discharge from the Moon Island outlet, the joint board states, covers "600 to 700 acres of the harbor surface, while the thin film of oily sleek extends to greater distances." Those sailing in this part of the harbor complain of these conditions. Investigations made in 1917 show that neither sewage nor suspended matter from any of the three main outlets reach the shores of Quincy Bay, except "possibly very light matters like grease balls, which are known to be carried many miles."

Board Averse to Testing Miles Process

As to the need for remedial measures at the three outlets, the joint board concludes that so far as the north and south metropolitan districts are concerned (with outlets at Deer and Nut Islands, respectively) nothing is required. No farther back than November, 1917, an extension to the north or Deer Island outlet was completed, so that instead of discharging at low water it now disperses the sewage at a depth of 32 to 53 ft. of water at low tide, where there is a strong current, through 14 outlets in a distance of 126 feet.

Neither are remediable works advised at the Moon Island outlet. The main conclusion of the joint board on this point, and on attempts to recover valuable matters from Boston sewage is as follows: "In the present circumstances, the need for improvement of conditions at Moon Island is not such, in the opinion of the board, as to warrant the expenditure of the funds needed for such an experiment [on a large scale to determine the practicability of the Miles acid process—Editor] and, in the opinion of the board, the further study of this problem can be safely postponed to a more favorable time."

Detailed Report by Goodnough and Clark

That part of the detailed report of Messrs. Goodnough and Clark which deals with the recovery of grease and fertilizer material from Boston sewage is presented in substance below.

"Normal domestic sewage of average strength contains, speaking broadly, a considerable amount of fatty matter and nitrogen and a small amount of potash. The recovery of these materials by a method which would be commercially successful has long been desired and actively and persistently sought by expert chemists and engineers in England, France and Germany, and to some extent in this country. Up to the present time, however, no process has been found that would adequately and satisfactorily solve this problem unless during the present war workers in Germany along these

lines, in their efforts to save and supply grease to the country, have perfected such a process. Of this we have no knowledge, however.

British and German Results Discouraging

"Studies of the literature of the subject and correspondence during the past year with prominent English engineers and chemists having charge of large municipal works for the disposal of sewage much richer in valuable constituents than that emptied into Boston harbor, have shown that at only a few places in England is any attempt made to recover grease from domestic sewage, and at none is it as yet an assured commercial success. At Bradford, Leeds, Huddersfield, Oldham, Norwich and other places in England, plants are operated for the recovery of grease and sludge-cake from the municipal sewage, but at most or all of these cities this sewage contains wastes from wool-scouring establishments. The practical results of each are probably fairly summarized in a statement from the Leeds authorities, as follows:

'Progress already made in this direction shows that in time it will be possible by artificial processes to get rid of all sludge without causing any nuisance, and make sufficient by the sale of by-products at least to pay the full cost of disposal.'

"In Germany before the war the various plants erected for this purpose had one after the other been pronounced failures and abandoned. Moreover, when we consider the extreme reluctance of woolen manufacturers and wool-scourers up to the present time of scarcity of grease and potash to erect plants for the recovery of these matters undoubtedly present in large amounts in waste wool-scouring liquor, the commercial failure of plants for their recovery from domestic sewage is not to be wondered at.

TABLE I. AVERAGE ANALYSIS OF SEWAGE ENTERING BOSTON HARBOR, JULY 17 TO SEPT. 27, 1917

(Parts in 100,000)

	Free	Ammonia Albuminoid Total	Ammonia Albuminoid In Solution	Kjeldahl Nitrogen Total	Kjeldahl Nitrogen In Solution	Chlorine	Oxygen Consume
Peddock's Island							
Raw sewage	1.40	0.33	0.18	0.68	0.36	13.4	2.31
Settled sewage	1.22	0.16	0.11	0.35	0.22		1.54
Acidified and settled sewage	1.33	0.17	0.11	0.35	0.22		
Deer Island							
Raw sewage	2.33	0.82	0.48	1.68	0.89	310.0	8.73
Settled sewage	2.11	0.56	0.39	1.07	0.73		6.22
Acidified and settled sewage	2.09	0.52	0.39	1.00	0.75		
Calf Pasture							
Raw sewage	1.80	0.45	0.20	0.97	0.41	325.4	4.12
Settled sewage	1.91	0.23	0.14	0.49	0.33		2.58
Acidified and settled sewage	1.78	0.24	0.16	0.49	0.33		

"For many years the Department of Health has made studies of wool-scouring waste in Massachusetts and of its valuable constituents, and has also made studies in regard to the fatty matters, nitrogen, etc., in domestic sewage, and in regard to the recovery of these matters from each liquor. Observations in regard to wool wastes, especially during the past ten years, have been made at many of the plants in the state where wool is scoured, but the most complete studies by the department have been made at Lawrence. At Lawrence approximately 75,000,000 to 100,000,000 lb. of wool are scoured in a normal year's operation of the mills.

"In 1910, 1911 and 1912 the State Department of Health made, by direction of the Legislature, extensive studies of the sanitary condition of the Merrimack River, and this study included many measurements of the volume of waste wool liquor produced at Lawrence and entering this river, and a large amount of analytical work to determine the character of these wastes, especially as to the amounts of grease, potash and nitrogen present. The results of these studies were published in 1913" ("Report of the State Board of Health upon the Sanitary Condition of the Merrimack River," House Document No. 2050).

Part of Lawrence Wool Wastes Now Recovered

"The report shows that in 1910, for example, the average volume of output from the first and second bowls of the wool-scouring machines at all of the wool-scouring plants of the city amounted to 211,000 gal. a day and that this volume of liquor contained on an average 29,000 lb. of fatty matters, 14,000 lb. of potash and 2200 lb. of nitrogen. That is, each gallon of liquor contained 0.14 lb. of fats, 0.07 lb. of potash and 0.01 lb. of nitrogen. Notwithstanding the large amount of valuable materials found in this liquor, however, the Department was not able at that time to persuade the manufacturing concerns of the city to erect a suitable plant or plants for the recovery of these matters.

"At the present time, as there is only a small available supply of potash and grease in the country on account of the war, and because of the greatly enhanced price of each two companies from outside the city are taking the richest wastes from nearly all the mill plants in Lawrence, and we are informed are making some profit. Plants for the recovery of grease from wool waste are also in successful operation at three or four other places in Massachusetts.

"One of the companies at Lawrence recovers both fatty matters and potash, while the plants of the other company are constructed to recover fatty matters only, these being worked up into lanolin, etc. These various recovery plants treat approximately 2,000,000 gal. of the richest wastes each month, or about 80,000 gal. a day, taking, however, only the wastes from the first bowl of each wool-scouring plant. * * * *

Studies of Metropolitan Sewage

"During 1917 many samples of the sewage entering Boston harbor from the sewer outlets at Deer Island, Moon Island and Peddock's Island were collected for examination and experiment to determine the total average volume of sludge and fatty matters settling out from the sewage in a few hours under normal conditions and also the volume of sludge and fatty matters settling out when the sewage from each outlet was acidified by means of SO_2 gas. [See Tables 1 and 2.] * * * * Potash results are not given in the table, as many examinations have shown that it is present in only negligible quantities and cannot be recovered.

"Comparing these figures with the figures obtained from Lawrence wool-scouring waste and reckoning the valuable constituents in pounds per gallon, it will be seen that the wool liquor at Lawrence contains 0.14 lb. of fatty matter per gallon, 0.07 lb. of potash and 0.01 pound of nitrogen, while the strongest sewage entering Boston harbor contains 0.0006 lb. of fatty matter per

gallon, a very small amount of organic nitrogen and practically no potash; or, in other words, each million gallons of wool liquor from the Lawrence mills contains 140,000 lb. of fatty matter, 70,000 lb. of potash and 10,000 lb. of nitrogen as compared with 550 lb. of fatty matter, a negligible amount of potash and 52 lb. of organic nitrogen per million gallons in the strongest sewage entering Boston harbor.

TABLE II. AVERAGE AMOUNT OF SLUDGE AND FATS OBTAINED FROM SEWAGE ENTERING BOSTON HARBOR AFTER APPROXIMATELY 18 HOURS' SEDIMENTATION, WITH AND WITHOUT TREATMENT WITH SO_2

	Peddock's Island	Deer Island	Calf Pasture
SO_2 used per 1,000,000 gal. sewage, lb	818	1,513	1,189
Dry sludge per 1,000,000 gal. of sewage:			
Acidified, lb	959	1,939	1,427
Unacidified, lb	762	1,709	1,208
Per 1,000,000 gal.:			
Acidified, lb	226	541	342
Unacidified, lb	183	373	269
Increase due to SO_2 sludge, lb	197	230	219
Fats, lb	43	68	73
Per Cent. of Nitrogen in Sludge:			
Acidified, lb	3 38	3 45	2 83
Unacidified, lb	3 10	3 56	3 18
Per Cent. of Fats in Sludge:			
Acidified, lb	27 30	19 40	26 30
Unacidified, lb	26 30	24 60	24 30

"In the work of the Sewer Division of the city of Boston, carried on at different times between June 20, 1911, and June 29, 1914, the conclusion was reached that with the use of SO_2, 1909 lb. of dry sludge were recoverable from each million gallons of sewage received at the Calf Pasture pumping station and that this sludge from each million gallons would contain approximately 436 lb. of grease. Shorter experiments with this sewage made by us show the dry sludge obtainable to be 1427 lb. and the fats obtainable with the use of SO_2, 342 lb. per million gallons. So far in this report, however, whenever comparisons have been made between waste wool-scouring liquor and the sewage entering Boston harbor, the strong sewage entering at Deer Island has been used for illustration.

"We are familiar with the report of Robert Spurr Weston, and the discussion of E. S. Dorr, on the economy of the Miles acid process of sewage tratement for the recovery of valuable materials from the sewage, and shall not undertake to enter into a criticism of the figures given by them in regard to the cost of erecting and operating a plant for carrying on the different processes necessary to recover sludge and fats from Boston sewage other than to say that these figures are based on estimates and not upon any actual data from construction of plants for the treatment of domestic sewage in this way or the cost of operation of such plants. By their figures a profit is shown from the recovery and sale of sludge and grease from the Calf Pasture sewage.

Against Building Works to Treat Boston Sewage

"Taking everything into consideration, however—that is, the commercial failure of practically all plants abroad when constructed and operated for the purpose of recovering valuable materials from domestic sewage and the great reluctance with which manufacturers enter into the business of recovering such materials from rich wool-scouring liquor containing probably at the least estimate four hundred times as much of value per gallon as domestic sewage—we do not feel justified in recommending at the present time the expenditure of money by the city of Boston or the metropolitan district for works of the nature proposed. Extended experiments and investigations on a large and practical scale would first be necessary for the accumulation of any reliable data in regard to outlay in construction, cost of operation and income to be obtained from such works.

"There is another side to the question, however, which has been urged by the experts already mentioned in this report, and that is the greatly improved character of the effluent from this process when compared with the sewage before treatment, and they urge that on this account alone the process is worthy of consideration, as the pollution of the harbor from organic matters would be materially reduced. They also urge as one of the reasons for this treatment the fact that the acid sterilizes the sewage or at least reduces to a very great extent the bacteria present. In regard to these two factors the following can be said: Table I shows that while the organic matter in the sewage, as indicated by the usual determinations of albuminoid ammonia, etc., can be reduced from 30 to 40% by this acid treatment, it is reduced to almost the same extent by sedimentation without the use of acid. The table showing the volume of dry sludge produced by sedimentation and by acidification followed by sedimentation, shows also that 75% as much sludge and fatty matters can be obtained by sedimentation as by acidification and sedimentation. The question naturally arises, then, is it worth while to spend approximately from $6 to $10 for SO_2 for each ton of sludge produced if this increases the amount of sludge and grease only 25%? Acidification of the concentrated sludge and at a much smaller cost could be carried on in order to 'crack' the grease for recovery.

TABLE III. AVERAGE BACTERIAL ANALYSES OF SEWAGE BEFORE AND AFTER ACIDIFICATION

	Bacteria per Cubic Centimeter		
	4 Days 20 Deg. C.	24 Hours, 37 Deg. C. Total	Red
Peddock's Island, raw sewage	1,860,000	415,000	298,000
Peddock's Island, sewage after acidification	94	91	9
Deer Island, raw sewage	2,360,000	1,150,000	650,000
Deer Island, sewage after acidification	147	85	15
Calf Pasture, raw sewage	1,890,000	980,000	730,000
Calf Pasture, sewage after acidification	277	149	39

"There remains the question of bacterial improvement, and this the process undoubtedly accomplishes as Table III, giving the average results of 50 bacterial determinations, illustrates."

State Maintenance Not Recommended for All Macadam Roads

According to the recent report of Charles M. Upham, highway engineer of Delaware, it seems to be within the scope of the state law to take over roads either for construction, reconstruction or maintenance. He strongly urges, however, that during the first period of the new program only those roads which have been recently constructed and are of an improved type be maintained by the state. Mr. Upham points out that if a large mileage of the macadam road system is taken over in its present condition, the yearly cost will be at least $700 per mile per year. This figure would burden the State at the outset with a large financial responsibility, whereas the money could be better used in paying the cost of new construction which would ultimately be more economical.

War Industries Being Brought Under Modern Engineering Control

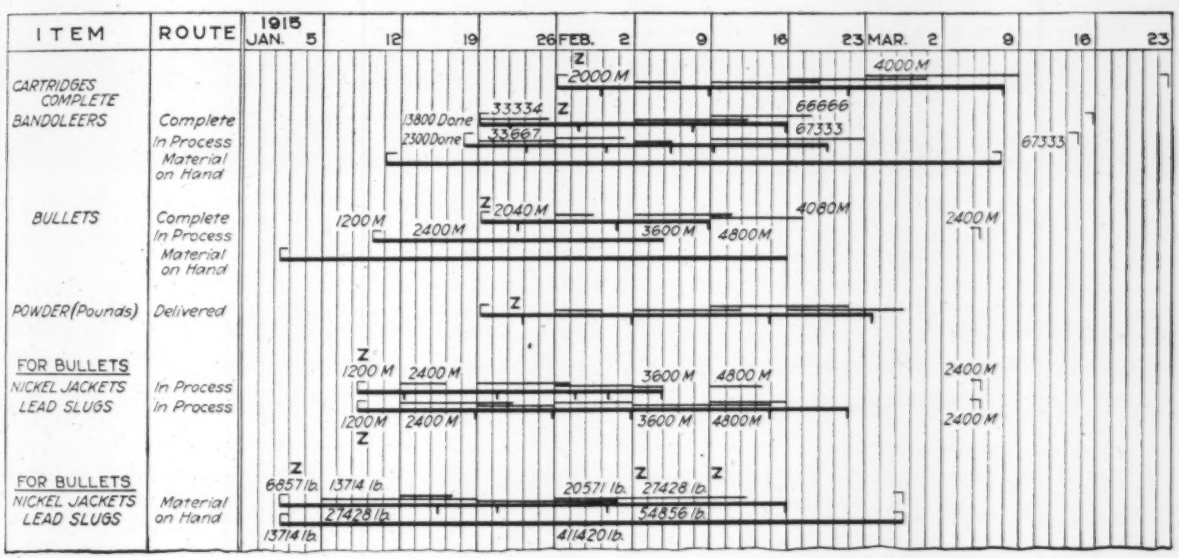
Use of Progress Chart by Ordnance Department Has Resulted in a Full Understanding of the Nature of the Work Ahead—Method Extending to Other Departments and Boards

By Mont Schuyler
Associate Editor, "Engineering News-Record"

GERMANY had prepared for a six months' war. Her supplies, her armies, her transportation system were all tuned for this period. For the general staff had figured the campaign with such precision—so they thought, at least—that any greater extension of preparation would be a waste of national effort. Only one man in the empire felt that the chance of plans miscarrying was of sufficient importance to provide against. His suggestions to Gen. Falkenhayn were laughed at.

This man, an engineer high in the counsel of the Allgemeine Elektricitäts Gesellschaft, felt that to enter into a project as subject to failure as a military campaign, without a plan whereby every resource of the nation might be concentrated on the effort, was suicidal. But his feelings ran counter to the convictions of the all-high command. He had to wait for the stalemate of December to obtain the opportunity of putting the whole of the industrial resources of the country on a planning and progress chart basis.

This sidelight on the military situation in Europe at the beginning of 1915 is neither invention nor rumor. It is fact, well vouched for by men of undoubted reliability. Therefore, it should be welcome news to the engineers of America to know that a start in the proper direction has already been made in this country. The Office of the Chief of Ordnance has had for some time a planning division in certain of its own shops, and is now extending this most important work to all the factories which are making supplies for the office. The Progress Section of the Control Bureau, this last functioning as a division of the Ordnance office, keeps its mind on the progress of all war orders within its jurisdiction. Under Major Sanford E. Thompson a corps of men, volunteers holding commissions in the U. S. Reserves, and all specialists in this work in their civil capacities, keep in touch with the promises and performances of manufacturers, determine wherein lies the cause of delays and what steps must be taken to keep production up to the schedule of requirements which have been determined as necessary to our full and successful participation in the war. No simple task, this.



COMPLETE HISTORY OF WORK IS GIVEN ON ONE CHART

With ordinary statistical methods it is probable that no appreciable result would have been attained, for the complexity attending the manufacture of an item so small as a ball cartridge involves the coördination of an amount of data that would be utterly undigestible unless reduced to a form which is visually understandable.

The use of "progress charts" is known to engineers as one of the significant contributions to the industrial development of the past few years. Here was a situation of a size that would prove, once and for all, the value of these charts and their adaptability to the greatest problems of today—for never before has such a trial been made. If the success which is indicated at the present moment is attained, it is safe to say that a new rationality will have come into industry to stay. For no plant which has once had the opportunity of benefiting from the application to production of sound engineering principles, of which the progress chart is an example, would willingly go back to the antediluvian,

hit-and-miss method of ordering, routing, and shipping. If once these principles attain a firm footing in the factories, there is no doubt that the application of progress charts will find wider fields. There seems to be no reason why futures of other and more general character should not be provided against in a similar manner.

The method is the logical outcome of the scientific management movement of the past decade. It purposes to set before the planning board of an industry the speed at which various parts of a mechanism or product must be completed, in order to avoid the delays which attend an unordered process. To do this properly presupposes a knowledge of the processes, an organization to collect the data during the period of manufacturing, and a body of men who are to reduce this statistical matter to comprehensible form, The difference between the progress engineer and the statitician lies somewhere in this last step. There have been statisticians in Washington before. There still are some there—and of value in the steps preceding the final analysis.

Leaving out of consideration the charts which show the demands as voiced by the general staff—not only because of their complexity, but also because of their nonengineering interest—attention is drawn to the accompanying illustration which shows, as an imaginary, not an actual, example, the planning involved in and the follow-up applied to an order for ball cartridges. Certainly there is something startling in the series of lines, light and heavy, which tells the whole story of the progress being made at a hypothetical plant. Yet one accustomed to an interpretation of such graphs could indicate the point at which the factory organization fell down, and, if at all cognizant of the processes connected with the manufacture of cartridges, could point out wherein the failure lay, what steps should have been taken to prevent the obvious delays, and what should be done now to remedy past mistakes and to avoid future trouble.

Before going into a somewhat detailed description of this particular chart, which is of the type evolved by H. L. Gantt, and originally introduced by him in the Ordnance Bureau, a short explanation of the various conventions and symbols is in order. Given a full understanding the meaning of these, there is nothing recondite or even difficult about the scheme or its application to any engineer who has once mastered the basic idea. He should have no trouble in applying the method to his own work, whether it be road construction or the manufacture of structural steel members.

The angle of the lower right quadrant, drawn in light lines, indicates the date on which the material should be on hand, started in process, or the time when final assembly should be initiated. This date is determined upon by the Government inspector after an examination of the plant and a consultation with the management. The terms of the contract also enter at this point, for obviously the date of delivery has much to do with the time at which the work should be started and the speed with which it should be prosecuted.

To the right of these angles will be found a figure which is the number of pieces scheduled for completion during the week. Until a different figure appears on the same horizontal line, this holds as the schedule. The light line below is the percentage of that week's allotment which was completed during that period. For instance, the light angle in the top line is witness to the fact that complete cartridges should be available at the beginning of the week of Feb. 2, and the figure shows that 2,000,000 should be delivered during that week. The small letter "z" (zero) records that no deliveries were made, while the light line in the next week's space, extending over three of the five divisions, signifies that 60% of the number expected during that week were completed. Similarly, in the following week, 140% of the 2,000,000 allotment was completed.

In some other cases, as under "Bandoleers Completed," more were finished during the weeks beginning Feb. 9 and Feb. 16 than were scheduled for these periods.

In such cases, the lines would overlap, so they are separated by a slight vertical displacement of the second week's line.

As a final step in the recording of any item entering into the complete cartridge, the light horizontal lines are added and the combined length is drawn as a heavy line, beginning at the point set by the light angle as the date upon which the route should be taken. Thus it may be seen that at the end of the week of Feb. 16 only 4,000,000 cartridges had been finished, although an adherence to schedule would have made 6,000,000 available. This deficiency was corrected during the following weeks, as may be seen from the chart.

This information can be obtained from a mere glance, and is surely more immediately apparent than a similar statement in figures. Furthermore, the same chart, in a space that an eye can easily cover at a glance, yields information which allows an almost absolute determination of the causes of delay; for the same principles that were applied to the progress of the complete cartridge through the factory can be and are applied to each of the separate items which go to make up the unit.

Furthermore, the material on hand is similarly plotted. The week-to-week history of the contract is set before the man responsible for the completion of that particular contract, and he is able to put his finger on the division of the work which is lagging and holding up delivery. An examination of the chart, based upon an understanding of the foregoing paragraphs, will show why deliveries of completed cartridgees were not begun at the time scheduled. In this case the trouble can be traced to the lack of sufficient powder. The chart shows that during the week of Feb. 2 the first delivery was made, while the schedule called for delivery during the week of Jan. 26. This first delivery was not enough to start work on, but taken with the deliveries during following weeks it was sufficient to bring the schedule up to the desired figure in a very short time.

These charts are made by the Government inspectors at the various plants, as a part of their routine duty. They are forwarded to Washington, finally getting to the hands of the Progress Section of the Control Bureau. Here they are reduced to the form in which they are to be used, plotted and analyzed. The section has no immediate control over the work at the factory, but keeps itself aloof and in the attitude of a student endeavoring to determine causes. In a sense, it is the "Intelligence Department," to use a phrase that is coming into wider use, in which the manifestations of disorder and misunderstanding are caught soon after their appearance,

and studied with the purpose of determining wherein the difficulty lies.

Nor must it be thought that the object of such work is criticism. Rather, the work functions fully only when it can forestall criticism. Its real purpose, then, is found in its ability to forecast trouble in such a manner that steps may be taken to prevent disastrous growth. The more complete the data on which such an organization works, and the more full its opportunity to digest the statistics which come before it, the greater service it can render. Where the limit of value of this modern service lies has not yet been determined. Today the further the analyses are pushed, the more definite and usable become the results.

It may readily be seen, since these charts are being kept up to date on every item which is required by the office of the Chief of Ordnance in its many activities, that master charts may be used to any extent that seems desirable or necessary. The statistics of the supplies for a complete unit, or even an expeditionary force, may be reduced to the same basis. In such form information in the hands of the general staff, for instance, can be made of incalculable value in determining the possible movement of troops, and in a manner to prevent the unfortunate situations that have been considered, in the past, inevitable accompaniments of large-scale military operations.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Shall the American Society Defeat the Revised Constitution?

Sir—It is extremely important that every member who can should cast his ballot for or against the proposed revision of the constitution of the American Society of Civil Engineers, but before doing so the subject should be fully understood. Ballots already cast may be changed by letter in advance of the canvass by the board of direction.

It is hoped that the majority of the committee on revision will be able to present to the membership full discussion of the matter before the ballots are cast. Difficulties of transportation and calls to other urgent duties no doubt prevented such a discussion at the annual meeting. In the absence of such detailed discussion, attention is called to the following:

The committee which prepared the revision was appointed by the board of direction and consisted of the following members: M. T. Endicott, chairman, J. A. Ockerson, J. V. Davies, George F. Swain, Hunter McDonald, Charles S. Crocker and Charles Warren Hunt. They were two years at the task.

The committee voted unanimously on all matters except that providing that the secretary should not be a member of the board of direction and that providing for the election of the secretary by ballot.

The board of direction, after receiving printed copies amply in advance, considered each clause in open meeting and voted practically unanimously on all questions except those above named.

In view of these facts there is no good ground for the misleading statement, which appears in the second paragraph of the resolution adopted at the annual meeting, namely:

"Whereas, it appears that the opinion of the members of the board of direction was greatly divided as to some of the changes; and . . ."

Throughout the meetings of the committee the secretary opposed these provisions, voted against them and on more than one occasion announced his intention to do all he could to defeat the constitution should it contain these provisions, both in the board of direction and before the membership. He has kept his promise. Members are requested to analyze the circular issued in opposition, both as to contents and personnel of signers. Attention is also called to the minutes of the board with regard to this question as published in the *Proceedings* for April, August and November, and members are asked to read between the lines.

It will be noted that although the secretary was instructed, in the absence of the committee, which had been discharged, to prepare the matter for submission to the membership, he did not do so, and it was finally done by the committee on publication, after the secretary had declared that he had complied with the instructions of the board.

It will be conceded, no doubt, by all that the separation of by-laws and constitution is desired and necessary.

All of the directors should be nominated by the nominating committee and elected by the membership, as now provided in one part of the constitution. This provision is nullified in another. The revision corrects this. The election of an extra director by the board of directors gives District 1 seven instead of six directors, as was evidently contemplated.

The changes other than those mentioned above have been few, but those which have been made tend to broaden the usefulness of the society in matters affecting the entire profession and the public. The fact that we are at war is a reason for, rather than against, the adoption.

If this is not now adopted, when and to whom may we look for something better? It is not contended that it is perfect. All such matters are the result of compromise.

HUNTER MCDONALD.
CLEMENS HERSCHEL.

The Donor's Version of the Austin Water-Supply "Gift"

Sir—In *Engineering News-Record*, of Dec. 6, 1917, p. 1056, there appears an article by Julian A. Montgomery, entitled "Water-Supply 'Gift' May Prove Expensive for Austin," which contains misstatements regarding me.

While my name is not mentioned in the article, the fact of the donation to be made by me to the public free schools of Austin has been given considerable newspaper notoriety in Texas, and it will be clear to many readers who may see the article that I am the per-

son who is the subject of the gratuitous reflections contained therein. These misstatements concerning me, appearing in a publication of the importance and dignity of yours, are rendered more injurious to my good name and reputation than would otherwise be the case because of the fact that I have been engaged in the operation of industrial manufacturing plants in Texas and elsewhere for the past forty years, and am therefore more or less well known to the engineering fraternity.

The first misstatement in the article is: "It was a case of school board arrayed against city administration and the school board won out, largely because of political reasons." The next misstatement reads: "These springs are owned by a defeated candidate for the office of mayor of Austin, who gave them to the school board provided the city would purchase them for $100,000 from the school board, the fund to be set aside as a memorial fund to this defeated candidate, and the interest to be used for manual-training purposes."

The concluding paragraph of the article is composed of the following tissue of misstatements and unwarranted conclusions:

"Coming at the time it did and with the condition imposed, the offer was embarrassing to the city administration, which was going carefully, but probably too slowly, into the question. Because the preliminary investigations were not finished at the time of the election, and because the people were impatient to obtain more water at once, and because of the political turn given to the question, the economic aspects were so clouded that there was forced on the city a source of water-supply which probably will prove more expensive and less desirable than some of the other sources that were being investigated."

In justice to myself and the school board and the city of Austin, I desire to state that several months ago I, as the owner of Barton Springs, desiring to improve the situation in Austin with reference to its supply of water for domestic and other purposes, and to at the same time increase the facilities afforded by the public free school system of the city for the manual and home economic training of the boys and girls attending the public free schools of the city, offered to give to the school board Barton Springs and the land upon which they are located, upon condition that the city would purchase the same from the school board for such price as might be placed thereon by the board, the proceeds to be used by the board for the purposes above referred to, without other conditions or limitations upon its authority and discretion.

The board, in so far as it could do so, accepted the donation, and placed a valuation of $150,000 upon the property. The matter was then represented to the city council, which, after discussing it fully and freely with the school board, expressed its willingness by a majority vote of its members to pay $100,000 for the property, but before definitely accepting the springs on those terms decided to submit the proposal to a vote of the taxpayers. The school board agreed to the reduced figure, and the matter was put to a vote of the taxpaying citizens and was confirmed at the election by a vote of 799 to 635.

The school board and the city council are composed of men and women of the highest type of character and honesty, and the two bodies were in no sense "arrayed against" each other, but were, and are, both trying to do the best thing for the city and its public free schools. That there were no "political reasons" because of which the proposal was carried is made evident by the attitude of a majority of the city council, and the support given such position by the people voting on the proposition. Hence, the first statement in the article referred to was entirely uncalled for and without foundation in fact.

I am not a defeated candidate for mayor of Austin, and have never aspired to that important office. I held positions of trust in the city government many years ago, but was never a defeated candidate for any such position.

In my offer to the school board there was absolutely no suggestion that the fund to be derived from the sale of the springs to the city should constitute a memorial fund for me or anyone or anything else, nor was it even stipulated that such fund should bear my name. The present school fund for manual training and home economics is utterly inadequate, and it was my idea that this fund should be supplemented by the proceeds of my donation.

The statement that the offer was embarrassing to the city administration is wholly gratuitous and is an unjust reflection on the governing bodies of both the city and its schools. Nothing that is approved by both such bodies and by the qualified taxpaying voters of the city should prove embarrassing to anyone concerned. Equally gratuitous and misrepresentative is the statement that "the economic aspects were so clouded that this source of water-supply was forced upon the city."

Austin, Texas. A. J. ZILKER.

[Mr. Montgomery's reply to the foregoing letter follows.—Editor.]

Sir—In furnishing the news referred to in the above letter it was my intention to make it a dispassionate statement of facts. I do not care to enter into a controversy about it, but for the further enlightenment of those who may be interested I desire to submit the following:

1. The article was supplementary and in further explanation of a former article contained in *Engineering News-Record* of Aug. 23, 1917, p. 355.

2. The article was intended to illustrate the lack of sufficient scientific investigation of municipal engineering problems, a custom which is unfortunately too much in vogue in certain sections of the United States. The facts show that the acquisition of the auxiliary water-supply, as outlined in the above-mentioned article, was of doubtful economic and municipal expediency.

3. It is an incontrovertible fact that to practically every purchase of real estate, or similar property, from private citizens by municipal authorities, there is attached, either directly or indirectly, more or less of politics. And to say that two bodies are politically arrayed against each other is in no way casting aspersions on them, for every day we find men and women of the highest and noblest type engaged in political work.

4. It is very significant that every engineer and geologist who investigated Barton Springs as a water-sup-

ply was opposed to the purchase of the springs as a water-supply—not on account of the water, which is excellent, but because it was thought that an ample auxiliary supply could be obtained considerably cheaper. The investigations made strongly indicated this.

5. It is a fact that the land on which the springs are located could have been condemned through court procedure and purchased for a small sum. A price as high as $2000 would have been excessive, especially since only a few acres would have been required, and since the taxable valuation as rendered was only a nominal amount.

6. The writer believes that at all times it is the duty of the school board to place first the schools it is serving, and it would have been negligent of its official duty had it acted otherwise. At the same time, the writer still maintains that the economic aspects were clouded by the political turn given to the consideration of the springs as a water-supply, and that a much cheaper and equally efficient water-supply could have been obtained.

Austin, Texas. JULIAN MONTGOMERY.

Colleges Not To Be Hindered in Turning Out Engineers

Sir—My attention having been called to a recent editorial of yours, written, evidently under some misunderstanding, I send you the enclosed copy of a circular letter which I am sending to the presidents of all colleges. Some of them, as in the case of your paper, jumped to the conclusion that, because we stated that the Government's emergency might require the use of all the technical resources, including those of the colleges, from May 1 to Oct. 1, this exclusive use would be required. As you will see from the enclosed communication, this sacrifice is to be required only as a last resort, and this board is as solicitous as anyone could be that the work of training engineers should not be interrupted. JAMES P. MUNROE,

Vice-Chairman, Federal Board for Vocational Education.

Washington, D. C.

[Mr. Munroe's circular letter to college presidents follows. The editorial referred to appeared in *Engineering News-Record* of Jan. 24, p. 153—Editor.]

"The Federal Board for Vocational Education desires to express its cordial appreciation of your courtesy in filling out the questionnaire recently submitted to you, and of the hearty spirit of coöperation shown by you and by the institution with which you are associated.

"In view of the fine zeal for immediate and complete service exhibited by the colleges and universities, it is perhaps necessary to make clear some points which, in the haste of preparing many documents, were not sufficiently brought out by us.

"The plan as outlined in our 'War Training Memo No. 88' is still under consideration by the War Department, and may be modified or, possibly, rejected altogether. Our information leads us to believe, however, that the plan, in substance, will be approved.

"The colleges and universities were summoned in conference in advance of a decision by the War Department for three reasons: 1. To secure as quickly as possible important information asked for by the War Department. 2. To have formal assurance of that full coöperation on the part of those institutions which we knew could be counted upon. 3. To save time in mobilizing educational resources should the War Department come to a favorable decision.

"Should the decision of the Secretary of War be adverse, the training of drafted men to be mechanics and technicians must continue to be carried on largely in evening, Saturday afternoon and possibly Sunday classes, by instructors not of draft age, and with funds secured from state or local sources. In that case, the combined educational resources of secondary grade will be so inadequate to the task imposed that the aid of the colleges and universities, when they are so located as to make this possible, will be imperatively required.

"Should the Secretary of War accept the propositions outlined in Memo No. 88 the universities, colleges and schools, both public and private, will be in position to give intensive training, in day classes, to drafted men on pay and subsistence, and will not be handicapped by the loss of instructors of draft age or by the necessity of finding funds.

"On the other hand, they will then be confronted by the grave questions of divided responsibility. The Government needs, for the successful prosecution of the war, trained engineers and trained mechanics, and the one need is seemingly as great as the other. How far, then, ought the college to sacrifice its training of engineers for the sake of meeting the emergency demand for trained mechanics, a demand so great that it is probably impossible for the secondary schools, public and private, to meet it alone? This seems to us a question which each college must decide for itself, but we hope that there may be the least interruption possible in the work with those of your own students who are fitting themselves for engineering or other technical service.

"Under pressure of developing war conditions, the needs in France for trained mechanics and technicians may be such as to compel a large number, if not all, of the technical colleges to suspend their normal, or their projected summer work from May 1 to Oct. 1, and to devote their whole energy to supplying the call of the Government for trained mechanics. We hope, however, that this will not prove to be the case, and that the situation will so develop as to permit of the technical colleges performing their full measure of service in the training of engineers, while at the same time, by taking on additional instructors and acquiring increased equipment, doing their fair share in the work of training mechanics and technicians. The performance of this double duty, financed, so far as the war training work is concerned, by Federal funds, is what the universities and colleges, it seems to us, should have in mind in the making of immediate plans.

"We would urge, however, that those plans be kept flexible to the latest date possible, so that, on the one hand, the regular work of the universities and colleges may not needlessly be sacrificed during the five months noted, and, on the other hand, those institutions may be ready, should the call come, to lend immediate aid, as far as they can, in carrying on those teaching services which, under normal conditions, would rest wholly upon the shoulders of the secondary schools."

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Dynamiting Cost Less Than Picking Old Road Surface

BY NORMAN SUPPLEE
Philadelphia, Penn.

IN RELOCATING a driveway on the property of M. R. Gano in Overbrook, Philadelphia, recently the contractors, Doyle & Co., encountered a 12-in. amiesite foundation. It took two laborers 4 hours to loosen up 2 sq.yd. with pick and shovel, after which both were ready to quit. There were 400 sq.yd. to remove.

The foreman tried 40% dynamite. Experiments showed that ⅛ of a stick in drilled holes at intervals of 2 ft. gave the best results. The shots were mud-capped to prevent material from flying. The entire road was then easily picked by two men in three days. The total cost of dynamiting, including labor and material, was $37.50.

For 50 ft. of its length the drive ran close beside the residence on the property, but there was no damage from flying stone or dirt.

Sluicing Method for Moving Earth Applied to Three Small Jobs

BY WILLIAM G. FARGO
Fargo Engineering Co., Jackson, Mich.

WHILE the usual conception of the sluicing method for making embankments is of a large scale operation, where the water supply is often diverted from a mountain stream at a high head, the method, with improvised equipment, is often economical on small yardages.

For example, the hydraulic method was quickly adapted in an emergency case under the direction of the writer's firm, using equipment at hand, in a southern Michigan village in 1914 for replacing and compacting portions of the head-race dike of a gristmill which had been washed out.

The head-race, half a mile long, winds along a low bluff at one side of a flat valley. A freshet had washed out the old timber dam and sections of the dike. It was desirable to close the breaks and let water into the race as quickly as possible. The best embankment material was the gravelly sand in the pit along the top of the low bluff.

To make the new embankment safe it was necessary to settle the fill with water. A pump must be installed for this purpose and as B. C. Drake, the superintendent in charge, was familiar with sluicing operations, he determined to use the hydraulic method for transporting and depositing the material. A 3-in. rotary fire pump was taken from the mill. Five hundred feet of old 2½-in. hose and nozzles were borrowed from the village fire department. Two sets of troughs were made as shown in the sketch, so one could be moved forward without stopping the work. The embankment was first brought approximately to the outline A, B, C, D, and water let into the canal so the mill could be started. The spillway in the meantime was inclosed in a cofferdam. The use of troughs for transporting filling material across the race made it unnecessary to provide a bridge for teams or to defer the turning of water into the canal. The amount of the fill handled by this simple hydraulic equipment was only 670 yd., which was placed and sloped in 5½ days of 10 hours each. The cost was as follows:

Troughs, 156 linear feet or 1,500 ft.b.m. @ $20.00 M, less salvage		$30.00
1—3-in. pump on hand, no charge.		
500 ft. of 2½-in. hose, on hand, no charge.		
Traction engine, 10 hp., with man, 6 days @ $5		30.00
Labor, 5 men, 2 days installing and dismantling @ $2	$20.00	
Labor, 5 men, sluicing 5½ days	55.00	
		75.00
Coal, 2,500 lb		6.25
Proportion supervision		15.00
Total		$156.25

$$\frac{156.25}{670} = 23.3 \text{ cents per cu.yd.}$$

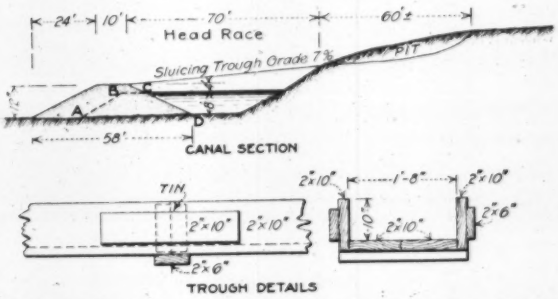
If the work had involved four times as much fill, or 2680 yd., adding the proportional labor, fuel and engine rental charges, the cost per cu.yd. would be 16 cents.

TROUGH USED FOR QUICK REPAIR TO CANAL BANK

In another case on which the writer was consulted nozzles and troughs were used for stripping the overburden from a limestone quarry along the Mississippi River. This quarry reached to the river bank and extended along it for some distance, making a long quarry face, the worked out portion being comparatively narrow and not much below the normal river surface. It therefore was possible to extend the sluicing troughs across the quarry to the river bank.

SLUICEWAY FROM PIT TO COFFERDAM SAVED BLOCKING HEAD OF CANAL WITH WAGON BRIDGE

The plant used consisted of direct acting steam pumps and California type monitors. This work, a nearly continuous operation with proper equipment, although not on a large scale, was done at a cost below 6 cents per yd., including all overhead and depreciation. The fact that the material handled, which was a clay loam, did not have to be placed in embankment, reduced the cost of handling by perhaps 30 per cent. These figures are based on labor at 20 cents an hour.



BREAKS WERE ALL BUILT UP TO FLOW LINE BEFORE FINISHING BANK

An example of the sluicing method for railroad cuts and fills was furnished in connection with an electric railway line in Wisconsin. This line, near Eau Claire, came up out of a wide valley and entered a long cut, all on a 6 per cent. grade. This being an ideal sluicing grade, the writer's firm assisted the railway manager in improvising equipment.

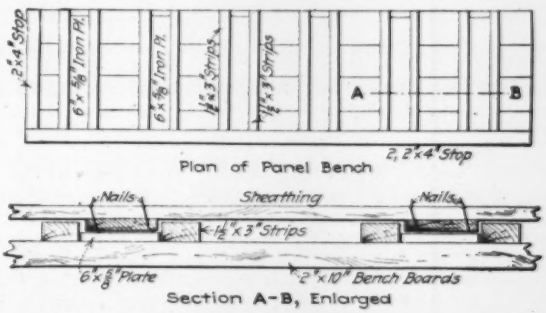
The pump was belt driven from an electric motor and second-hand steel troughs were bought. The hose was 4 in., and nozzles 1¼ in. at tip. It was found cheaper to widen the cut and deposit the embankment with rather flat slopes than to confine the fill to the usual one on one and a half slopes with batter boards. Railroad or highway grades of 5% or more, where such grades are continuous and suitable soil is obtainable in the cuts or alongside, are frequently adapted to sluicing, provided water and cheap power are available and the equipment charge can be kept within bounds.

While it seldom pays to set up large capacity, efficient improvised sluicing apparatus for placing less than 50,000 yd., if a small daily output will suffice, say 100 to 500 yd. may frequently prove economical. The material most easily moved and placed in sand. Clay in amounts from 5% to 15% mingled with the sand, either in disseminated form or in scattered masses or thin seams, will help to lubricate the troughs and will not give trouble in the embankments if reasonable precautions for drainage are taken.

Metal Strips on Framing Tables Clinch Form Nails

BY CHARLES A. ROOS
of Roos Brothers, Engineers and Concrete Contractors, Cincinnati, Ohio

SMALL iron plates laid on top of the framing table under the battens are used on work of the writer's firm in making up form panels to clinch the nails. The top of such a framing table, with the plates in place and a panel in position for nailing, is shown in the sketch.



NAILS DRIVEN SLANTING AGAINST PLATES

In order to make the nails clinch more easily they are driven into the lumber at a slight slant.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Illinois Society Unites Sections With General Meetings

Land drainage, street paving and the good-roads movement were the principal subjects considered at the annual meeting of the Illinois Society of Engineers, held at Quincy, Jan. 24 and 25. In expectation of an attendance insufficient for holding separate meetings of the different sections, the plan was adopted of assigning certain portions of time of the general meeting to the sections, whose respective chairmen presided during these periods. Brief but brisk discussion on a variety of subjects was a marked feature of the proceedings.

The legal aspects of land drainage were the subject of extended discussion, following the presentation of a paper on the merits and defects of the levee act, by M. S. Gilbert, attorney, of Cairo.

Records of reclamation work, to be compiled by the state authorities, were recommended by the resolution.

Various aspects of street paving were discussed. A paper on vertical-fiber brick paving, by G. N. Reiter, started considerable discussion as to fillers and cushions of sand, asphalt, pitch and cement grout. Mr. Chatten, city engineer of Quincy for many years, preferred pitch, as the result of experience with all of the fillers mentioned. Bituminous foundations for paving were discussed by L. Kirschbraun. His idea is that a bituminous-concrete base may be used as the pavement while traffic is light, and can be covered with a wearing surface when the traffic has become heavy enough to require this treatment. Concrete curbing and the use of the roller and belt for finishing concrete paving were dealt with by C. M. Powell, and Chicago's paving work of 1917 was reviewed by H. J. Fixmer. These four speakers were from Chicago. Water content in relation to the wearing properties of concrete paving was discussed by Professor Abrams, of Lewis Institute. Tests indicate that deficiency of water is better than excess.

Good roads received attention mainly from the promotional and educational viewpoint, in connection with the proposed $60,000,000 Illinois bond issue which is to be voted on this year. A resolution favoring this bond issue was adopted. Many highway commissioners and others had been invited to attend this session, at which brief addresses were made by W. G. Edens, of the Illinois Highway Improvement Association, and S. E. Bradt, superintendent of highways. Proposed plans for work in 1918 were outlined by Clifford Older, state highway engineer. Handling of materials on road-construction work was dealt with by W. Ord, of Cleveland, who favored the use of the industrial railway. This view was endorsed by B. H. Piepmeier, of the State Highway Department, who thought motor trucks likely to be less successful in the flat country and muddy soil of Illinois.

Changes in the structural engineers' licensing law were suggested by Cephas Holmes, of Macomb, and to carry these suggestions into effect the society will coöperate with the Structural Engineers' Society.

To insure proper operation and maintenance of sewerage and sewage disposal systems in the smaller cities and towns an engineer should be employed to make periodical inspections and reports. This was the substance of a paper by W. T. Barnes. The work of the water survey division of the new State Department of Public Works and Buildings was outlined by G. C. Habermeyer, acting director of the division.

The officers for 1918 include J. G. Melluish, of Bloomington, president, and J. W. Dappert, of Taylorville, vice president. The secretary is E. E. R. Tratman, of Wheaton. The next meeting is to be held at Bloomington. The society's "service flag," displayed at the meeting, indicated 17 members now in service in the army and navy.

National Chamber of Commerce To Ballot on Water-Power Development

The Committee of the Chamber of Commerce of the United States, appointed to investigate water-power development, has made its report, and a ballot embodying the committee's recommendations was mailed Feb. 6 to half a million American business men included in the membership of the 985 commercial organizations which are members of the national chamber.

Of the 11 members of the committee, three are well-known engineers. They are the chairman, L. S. Gillette, of Minneapolis; Dr. Henry S. Drinker, President of Lehigh University, and Prof. George F. Swain, of Boston. The other members of the committee were Horace C. Henry, of Seattle, railway contractor; H. A. Black, of Galveston, merchant; Rome G. Brown, of Minneapolis, lawyer; Frank P. Glass, of Birmingham, editor; E. K. Hall, New York City, lawyer; H. L. McCune, lawyer, Kansas City; C. G. Weed, banker, Boston, and the Hon. S. V. Stewart, governor of Montana.

The recommendations of this committee follow:

(1) That Federal legislation encouraging the development of water powers should be at once enacted.

(2) As to all developments, whether within or outside the public domain, a separate act of Congress should not as at present be required for each development, but the authority to issue permits should be vested in some department or commission designated for that purpose and under conditions protective of the interest of the public and of the investor.

(3) Permits should be issued for a period of at least 50 years, unless at the option of the applicant a shorter

(Continued on p. 333)

Canadian Government To Build Ships

The Hon. C. C. Ballentyne, Canadian Minister of Marine, announced on Jan. 3 that the Canadian Government had outlined plans for utilizing to full capacity the Canadian shipyards for the production of modern steel cargo steamers, of the most approved types, for the use of the Government and for registry in Canada. The capacity of these yards is roughly estimated at from 275,000 to 300,000 tons. At some of them, vessels are now being constructed for foreign account. During the war and for some time afterward the construction of steel ships for foreign registry will not be permitted. The naval construction branch of the Department of Marine has under consideration the construction of three types of ships. One of these will comprise vessels suited for service on the Great Lakes. Another type will comprise ships of from 5000 to 7000 tons, and the third, vessels having a deadweight capacity of from 8000 to 10,000 tons.

One of the chief difficulties arises from the fact that steel plates and shapes are not made in any quantity in Canada. The Government program embraces the establishment at Sydney, New Glasgow and Sault Ste. Marie of rolling mills in connection with existing steel plants, for the turning out of steel plates and shapes. Charles Duguid, Government naval architect, is to be technical officer in charge of the new undertaking. Mr. Duguid designed all the newer Government steamers and has had many years of practical experience in shipyards on the Clyde and elsewhere in Britain. The total expenditure involved in the enterprise is estimated at between $50,000,000 and $60,000,000.

Government Housing Plans Once More Changed

Latest Development Centers All But Shipping Board Housing Under Department of Labor with New Appropriation

In *Engineering News-Record* of Feb. 7, 1918, p. 276, there was printed a resumé of the Government housing plan up to the first week in February. As stated there, a conference had just been held at Washington, which was attended by representatives of the Secretary of War, the Secretary of Navy, and the Secretary of Labor, as well as the chairman of the congressional committees in charge of the appropriation bills on housing. At this conference it was definitely decided not to centralize the housing activities of the Government, but to allow the Army, the Navy and the Shipping Board, which are the three branches most concerned with the housing problem, each to have its own organization conferring with the Committee on Housing of the Council of National Defense and possibly coördinated by a governing committee made up of the heads of each of the housing branches.

Centralization of Control

Since that time it appears that the Department of Labor has convinced the President that a certain degree of centralization of control of housing is necessary. Secretary of Labor Wilson has announced that entire power over the matter of housing workers in all the war industries has been delegated to the Department of Labor. This, it is understood in Washington, will be subject to the restriction that the Shipping Board activities are outside of the control of the Department of Labor. The Shipping Board has a bill before Congress, with very favorable prospects of passing, appropriating $50,000,000 for housing in the shipyard towns. This appropriation will continue to be administered by the Shipping Board under the direction of J. Rogers Flannery, with the coöperation of the Housing Committee of the Council of National Defense. Another bill for $50,000,000 has been introduced into Congress for the other war activities; that is, mostly in the towns where munitions manufacture is going on. This appropriation will probably be under the final supervision of the Department of Labor.

Three Housing Organizations

Organization of the Department of Labor's control has not yet been announced. It is understood, however, that the War Department and the Navy Department will continue each to have its own housing organization engaged in the work of design, construction and supervision. These departments will be closely affiliated with the Department of Labor's organization, however that may be developed.

The Broad Point of View

Momentous Developments in the War and the Industrial Situation as Seen from Washington

By Wingrove Bathon

Washington representative of the McGraw-Hill Co., Inc.

The trained observer in Washington today sees some things clearly, and some of the pictures are dark ones. In finance, particularly, that is so.

A few days ago the United States Treasury disbursed $86,000,000 in one day. And now is it getting to be pretty well understood that before the end of the fiscal year, for the war needs of the United States and the Allies, the sum of $10,000,000,000 must be raised! Think of it! The mind does not grasp that sum.

Where is this $10,000,000,000 coming from? No one in Washington knows now. No secret is betrayed when it is stated that officials of the Government are frankly worried, and it is also an open secret that the banks of the United States are still clogged with the bonds of the Second Liberty Loan which the people have not bought.

Place of the War Finance Corporation

The sum of $10,000,000,000 must be raised with which to run the war, but there must be money raised, too, with which to run business, so that the business may produce in taxes the money with which to run the war. In this situation, now being driven home with force in Washington, it is proposed that Congress shall create what is to be called a "War Finance Corporation," with a cash capital of $500,000,000 and with authority to issue and sell $4,000,000,000 in short term notes, for the purpose of financing private war industrial operations. These phrases are other terms for the creation again of priorities—this time priorities in money, and this time for private industry, not for the Government.

It is a trifle early to say what Congress will do in regard to the proposal. Be that as it may, the best judgment obtainable in Washington, where so many leaders in the industrial world are now living for the period of the war, is that some form of "War Finance Corporation" to keep private industry going has now become a vital necessity. The word "industry" is used in the broad sense to include commerce and transportation, even electric railway transportation. There must be devised some plan by which conductors of small operations not needed for the prosecution of the war can be prevented from taking capital actually needed by concerns engaged in industry essential to the war.

England Works for "After the War"

In the meanwhile, those who are preparing in this country now for additional war taxes will do well to turn their eyes toward England. England has already begun upon after-the-war construction. The English government is developing a great plan to reclaim and colonize Mesopotamia, where 25,000,000 people will live in what is now a desert. Incidental thereto, it is reported, are large harbor developments, railroad construction suitably located, etc., and from this will start the rehabilitation of the valley of the Tigris and the Euphrates upon such a stupendous scale that to compare what was done with the Nile and the Assouan Dam would serve to show the latter as a small affair.

If England is able to reach out and do after-the-war work now, why should not the United States be able to do so? Does not this story of England's enterprise carry with it a lesson for the American business man? England's revenues, according to the latest official figures which have reached Washington, have expanded beyond the estimates. From that fact we must take comfort, for if they continue to expand perhaps England will not need to raise as much money in the United States as she has needed in previous loans from this country.

French Contracts Canceled

Many other very interesting things are coming to the surface in Washington. A good portion of the money that was tied up in Russian contracts is of course diverted; and recently the French government, pointing out that nothing is to be gained by paying for machinery and materials in this country unless ships can be furnished to bring the machinery and materials to France, had its representatives here discuss with American contractors a basis for the liquidation of contracts here, and millions of dollars worth of machinery contracts were so liquidated.

As to Russia in particular, business men who are now in Washington insist that there is no cause for alarm concerning the future. One of these business men is Col. William Boyce Thompson, of New York, who has just returned from a six months' trip to Russia. He is now in Washington endeavoring to persuade Secretary Lansing of the State Department, members of the Senate and House, Foreign Affairs Committees, and other officials of the government who are concerned with our foreign relations, that it would be the part of wisdom for the United States to recognize the Bolsheviki forthwith. There are indications in Washington that something of that sort may be done—if not a recognition at least some words of encouragement may be sent. Col. Thompson, while in Russia, sent $1,500,000 out of

his own pocket to the Bolsheviki so that they might use the money for propaganda purposes among the workingmen in Austro-Hungary and Germany.

Growing Power of the Treasury

World markets and the international aspects of industry, however, are not completely occupying the attention of the Washington observer. There is much gossip going around in regard to the growing power and responsibilities of Secretary McAdoo of the Treasury Department, a subject that seems to be a fitting part of this letter, inasmuch as most of it has been devoted to finance. If there is one thing that will stand in the way of the easy passage by Congress of the "War Finance Corporation" bill, it is the fact that Secretary McAdoo has had thrust upon his shoulders almost too much work, almost too much responsibility. A "fiend for work," to use the language of the day, he has seemed not to be burdened by the many additional duties he has inherited, but the Washington observer is wondering when there will come an end to the making of demands upon his time.

Highways and Power Plants

There has been too much of a let-up in too many fields already. In the highway field, the government has taken a negative attitude. Apparently, from the way things look now in Washington, if capital is to be granted for the maintenance and extension of the highways, it will be in exceptional cases. But the highways must be maintained and developed, as a war measure. With the failure of steam transportation, motor truck lines are coming more and more into use. In nearby Maryland alone there are now 50 motor truck lines carrying freight and express matter, with an average for the express lines of 100 miles per truck, and there are 31 motor truck lines carrying passengers, all operating under the Maryland Public Service Commission. It will be absolutely necessary to sell bonds for the maintenance and construction of highways. A "War Finance Corporation," properly founded and administered, could see to that. There must be money for more power plants because of the coal situation. It is not at all certain that the power-from-coal question will be solved by the arrival of good weather and the restoration of steam traffic facilities. The nation is using much more coal than it ever used before. More power plants or expansion of present power plants is indicated. England is talking about expanding by creating five or six "super" power stations, to supply all of her industrial power needs. In any case, capital must be obtained, and the best thought obtainable in Washington is that a properly founded and administered "War Finance Corporation" could be of the greatest service to industry along that line.

Road Builders Want Federal Highway Policy Defined

The director general of railroads is to get from the American Road Builders' Association, which met in St. Louis, Feb. 4 to 7, a strong resolution calling for some definite expression as to the Federal policy concerning road maintenance and construction. A committee headed by H. E. Breed, president of the Association, was instructed to go to Washington. Assurance is desired that car service will be furnished for hauling materials to build roads conforming with that policy.

A new standing committee on uniform traffic regulations was named following a discussion precipitated by a paper on the subject by W. A. McLean, deputy minister of highways, Ontario, Canada. Restrictions on traffic loads was advocated by Mr. McLean. The engineer must know standards for which he is designing. Ontario regulations are 650 lb. per inch width of tire. A paper by S. M. Williams, of the Garford Motor Truck Co. and president of the newly-formed American Highway Industries' Association, analyzed the relation of the highways to other forms of transportation. Ray mond Beck of the Highway Transport Committee described the delivery of convoys of motor trucks from the fac tory to the seaboard. Efficiency of th motor truck in terms of cost per ton mile was discussed in a paper by R. E Chamberlain, manager of motor-trucl sales, Packard Motor Car Co.

Brig. Gen. E. Everett Winslow, Corps of Engineers, U. S. Army, sent a long message which drew the fire of some of the members. It stated that in general the road problem was largely of local benefit and the cost should be borne locally. To what extent it is a national question was for Congress to decide. In the discussion it was pointed out as an example that on a trunk line road in New Jersey, three-quarters of the traffic originated outside of the state. Contracts more equitable for the contractor were urged in a paper by James C. Travilla, consulting highway engineer, Dunn Wire-Cut Lug Brick Co.

Engineers in Government Service Asked to Enroll

The Engineering Council, through its American Engineering Service Committee, has assembled in its offices in the Engineering Societies Building, New York, lists and much information concerning engineers. To maintain these lists in the most useful condition, the committee should receive promptly information concerning each engineer who has gone into Government service.

Engineers reading this are urged to send at once their names, present addresses and occupations in the Government service, with brief statements as to whether or not they are available for other service, to American Engineering Service Committee, Room 901, 29 West 39th St., New York.

Board Appointed to Control All Nonmilitary Training for Army

Civilian Advisory Committee Will Furnish Necessary Contact with All Educational Institutions and Agencies

A board to take over the control and direction of all nonmilitary training for war department needs has been appointed by the Secretary of War. It is composed of three army officers appointed by the secretary, these to nominate five civilians to complete the committee.

This is the consummation of plans on which the Committee on Relations of the Engineering Schools of the Council of National Defense, and other official and unofficial bodies, have been working for some months. The board's scope will extend to every phase of education—university, secondary, vocational and that carried on in the industries. To it will be committed such matters as the disposition of engineering students subject to draft, the education of wireless engineers and the training of wireless operators, mechanicians, machine shop and shipyard workers—in fact, all training of a nonmilitary character having a bearing on war work. It will have the power to detail men to the schools on pay, to compensate the educational institutions, to lay out and approve courses of study.

It thus centers in one agency the educational work which was in danger of being scattered. The Federal Board for Vocational Education had made a request affecting the operation of engineering colleges—institutions outside the board's delegated scope—while various agencies were seeking consideration for students of special subjects.

The board will report direct to the chief of staff of the army. The personnel of the board has not yet been announced.

Reassignments Made in Navy Corps of Civil Engineers

Following the assignment of Civil Engineer Parks to become chief of the Bureau of Yards and Docks of the Navy, other officers of the Corps of Civil Engineers have been shifted. Civil Engineer George A. McKay, who has been public works officer at the naval training station at Great Lakes, Ill., has been ordered to duty at the naval station at Pearl Harbor, Hawaii, succeeding Rear Admiral Parks. Civil Engineer Walter H. Allen has been moved from the navy yard at New York to Great Lakes, and Civil Engineer Richard C. Hollyday from Norfolk to New York. Rear Admiral Frederick R. Harris, civil engineer, U. S. N., who has been chief of the Bureau for the past two years and who was for a few weeks general manager of the Emergency Fleet Corporation, has been ordered to the Navy Yard at Norfolk, as public works officer there.

Ballot on Water Power Development

(*Continued from p. 330*)

period is agreed upon, and should be irrevocable except for cause.

(4) A toll should be imposed by the Government only on power developments on the public domain or benefited by head-water improvements maintained by the Government. Such tolls should be based upon the horsepower actually developed, used and sold. The tolls should be reasonable, and proportionate to the benefits actually derived.

(5) If public lands form only a small and incidental part of the entire development, the licensee should be entitled to acquire the right to use such lands, paying the Government fair and just compensation for such use.

(6) At the expiration of the license period the Government should have the right to recapture the property for itself or for a new licensee upon the payment of fair and just compensation for the property and for all dependent property, if taken; and if the dependent property is not taken, then fair and just compensation should be paid for all severance damages. Provision should be made that, all things being equal, the original licensee have priority over any new licensee.

(7) At the expiration of the license period, the Government should (a) agree with the licensee as to the terms of a new license; (b) recapture for itself for a new licensee; (c) continue the license under the original terms.

(8) Rates and service should be regulated by state commissions where the service is intrastate and only by Federal authority where the service is interstate and the commissions of the states which are directly concerned do not agree or there is not state commission.

The exercise of any Federal jurisdiction over the issuance of securities would be unnecessary and unwise.

No preference should be allowed as between applicants, whether a municipality or otherwise, which amounts to the granting at the expense of the Government of a subsidy creating unequal competition in the same market

Navy Builds Huge Warehouses

Work has been started on the first unit of a United States naval supply base to be built inside the area of the Bush Terminal in South Brooklyn, New York City. The main unit consists of two U-shaped reinforced-concrete buildings eight stories high, 700 x 200 ft. in area with a 45 x 550-ft. court. Each building contains about 950,000 sq.ft. of floor space. In the same contract will be 3 one-story mill construction buildings 300 x 360, 300 x 380 and 300 x 460 ft., respectively, having a total floor area of about 500,000 sq.ft. The whole contract, which amounts to about $5,500,000, is held by the Turner Construction Co., New York City, which has already started work.

Troubles of a Technical War Correspondent

R. K. Tomlin, Jr., Representing "Engineering News-Record" in France, Tells His Experiences

In December, *Engineering News-Record* sent its managing editor to France to get technical articles relating to the war. His first contribution appeared in the issue of Jan. 31. The difficulties experienced in getting the desired data contrast so with conditions here that the following letter from Mr. Tomlin (written as a report to the editor) will probably interest all readers:

"Things are looking up a little since I wrote you last. I mailed you yesterday story on organization of American road-building, which was approved by the military censor and by H—— with practically no changes. I felt very happy to send you some 'copy' at last and to have it go through without revision. Of course, you will realize that we can treat of military matters only in very general terms, and in the stuff I send you I realize that many important questions which an engineer might ask must go unanswered. Possibly it might be well to mention this matter in a brief editorial note. Otherwise some reader will say, for instance, why didn't he tell us how many men will be required on maintenance per mile, etc., or what is the length of front and number of men served by these roads. Answers to such questions, of course, are absolutely inadmissible.

Trying for Articles

"I have also written a short article on bridge design after seeing your friend M——. This will be sent to you as soon as M—— O.K.'s it. The prospects are bright, also, for a story on light railways (narrow gage, portable track), if the promise to give me this stuff materializes, as I feel it will. May also get something on water-supply—negotiations now pending, also possibly something on wharves and docks. However, I will know I have these tales only after I get them into the mails. You don't always get what you think you have cinched, over here.

"It is well for you to know that all of our work here is in a *very* preliminary stage. Some of the tales we heard about big construction under way are the sheerest tommyrot. The real big stories are a long way off. For instance, the matter of huge programs of building in devastated areas is ludicrous. There are three good reasons: No men, no money, no machinery or materials. Each one in itself is a complete answer. Combine the three and draw your own conclusions.

"Tell B—— I saw his friend G——. Asked him about operating economies on subway here and he said: 'There are none—when they want to economize on coal they cut down on the number of trains or stop traffic entirely. That's all there is to it.' Still, I will pursue this subject further when I get time.

"I understand, however, that there is some hydro-electric development in southern France, but it is a big job to get out of the city—military permits, police permits, press permits and a score of formalities to go through. I shall stick around here and get stuff while the getting is good before embarking on any long journeys with no definite prospects of getting anything on the other end.

No Small Task!

"Things move *very slowly* here. In fact, I thought I was making little progress until I talked with others, engineers both in and out of the military service. Now I feel quite satisfied with myself in having placed a story in the mails 12 days after arriving in Paris. And let me outline briefly the steps which the road story involved: (1) Finding out who was in charge of the work and where I could reach him—*no small task!* (2) Going to see him. (3) Being requested by him to get permission to prepare story. (4) Trying to find some one who would give me this permission—*this took two or more days!* (5) Being promised a letter authorizing preparation of articles. (6) Going back and getting this letter. (7) Proceeding with this letter to road man's headquarters, a long hike, and finding him out. (8) Going again—this time I got to him. (9) Interviewing him. (10) Writing story, long-hand. (11) Trip to stenographer to have it copied—(censor must have carbon for his files). (12) Back to stenographer to get typed manuscript. (13) With typed manuscript to road man for approval—not in, so left it at his office. (14) Back to him again and got story approved. (15) Took approved story to censor and left it there for examination. (16) Back to censor to get story. (17) To post office to learn postal charges. (18) And, finally, deposited envelope containing manuscript in mail box—Thank God! It's sure hard on shoe leather! (This 'operation No. 1, No. 2, etc.,' will interest V—— of the *American Machinist*.)

"Tell Miss P—— and the girls that did my work in the typewriting department that I never really appreciated what this excellent service meant until I got over here in Paris and tackled a so-called 'French-English' stenographer. Anybody that ever kicks about service in the McGraw-Hill outfit ought to be sent to Paris and have his work handled by some of the local talent. This would be a permanent cure. Believe me, I know what I'm talking about. The same stuff goes for the telephone service—which will interest Miss N—— and Miss W——.

"Subway here stops at 11:30 p.m., so if you get stranded somewhere beyond this hour you either walk home or submit to highway robbery at the hands of a taxi-driver. This species is more rapacious at night than in the daylight and Americans are choice prey for them.

"We had warning of an air raid about a week ago. Fire engines, with

sirens going full blast, tore through streets sounding the alarm. I was eating dinner with a bunch of newspaper men in a little restaurant near here and the woman who runs the place rushed out and pulled down iron shutters over windows and doors. We were all expecting something interesting to develop, but nothing happened.

"Was talking here with one of the boys of the engineer outfit who was in the Boche raid at Cambrai. This has all been in the papers here so I see no reason for not mentioning it. He says some of the regiment, without rifles, disposed of several Germans with shovels and picks which they were using on railway repair work. These follows are seeing real action.

"It is quite uncertain as to just when I will be able to get out to the front. It is a difficult job getting the permission and *finding out where you ought to go to see interesting work.* Then, too, the matter of transportation is a *huge* question in itself. This will take time and I know you will be patient. If you could only be here with me for a while, you would see more clearly than it is possible to see from the States what an entirely new set of conditions we are facing. American standards simply do not apply here."

To Represent Technical Engineers Before Wage Commission

Unorganized employees of railways were asked to present their troubles before the Railway Wage Commission, Feb. 11. On behalf of the technical engineers the American Association of Engineers has prepared a resolution asking for recognition for the expert services rendered and commensurate compensation, together with data as to salaries now paid in various grades. This action was not taken solely in the interest of members of the association, but is designed to aid engineers in general, whether they have or have not affiliations with any engineering society. The resolutions emphasized the point that by reason of the inadequate salaries paid many capable engineers have gone into other pursuits and that today the railroads are experiencing delay and damage for want of skilled technical men to carry on operation, maintenance, construction and the necessary planning for future work.

The position of the association is set forth as follows:

"The laborer is worthy of his hire and his hire should be a just reward for his work. That just reward the technical man has never had and we appeal to you to give it to him. He comes to you with no threat; he wields no 'big stick,' but he believes that a tribunal organized to dispense justice will dispense it because it is just and not because it is extorted."

The president of the association, Edmund T. Perkins, was selected to present the resolution and Isham Randolph, consulting engineer, was delegated to submit and explain the data upon which it was based.

Waterway Navigation To Be Under Government

Indications Are That Rivers and Canals Will Soon Be Taken Over By Director of Railways

Washington Correspondence

Government control of inland waterways is imminent. A clause in the pending railway bill extends governmental authority over all such waterways, but even if that clause is amended or omitted in the act as passed, the President has sufficient power to take over canal and river transportation. Director General of Railways McAdoo, on the strength of that authority, is reported to have taken the first steps toward the control of waterways, by the tentative selection of an eminent railway man, expert in traffic matters, to head a division of waterway transportation. Associated with him there will be a high officer in the Corps of Engineers, who will furnish the expert knowledge of rivers and canals, and probably other experts on matters of trade movements, navigation and traffic management.

The problem today is a large one and one materially changed by war conditions. In the first place, all possibility of railway opposition is removed because the same office will control both rail and water movements. Routing of freight to utilize the maximum possibilities of all modes of transport will therefore be possible as it never was before. At the same time, the necessities of freight movement are very different from what they were before the war. Today the main need is not only to get war goods to the seaboard for transoceanic shipment but also, so to divert freight from rail to water as to release the sorely needed equipment and personnel from side and connecting railway service to the coast-bound lines where both are scarce. Abundant data as to the possibilities of waterway transportation are on record in both Government and private files, but all of this data is subject to alteration on account of the present changed conditions. For that reason, it is understood that Mr. McAdoo will order a rapid survey of the waterway navigation conditions and possibilities, on the basis of which early action will be taken as to the Government's procedure in the matter.

For the time being the New York State Barge Canal has a different status from the other waterways. Several large interests are now awaiting the Government's action before deciding whether to enter the freight carrying field on that waterway. Before the Senate Commerce Committee, G. A. Tomlinson, a lake shipper and business man of Duluth, Minn., testified that he was willing to start immediately on the construction of a fleet of 100 barges for the Barge Canal and would guarantee that they would be provided with capacity freight in both directions. He stated, however, that he could not go ahead with the project if the Government took over the canal and commandeered his equipment. It is understood that there are several other large interests in the same state of mind. On this account there is a disposition on the part of the Government authorities to permit the private interests to go ahead on the New York canal system, at least for the coming summer. This decision, however, will probably await the rapid survey.

Bowles Takes Charge of Shipyards

Rear Admiral Francis T. Bowles, Managing Director of the Emergency Fleet Corporation, on Feb. 5 assumed entire charge of the shipyard the Government is erecting at Hog Island, in the Delaware River below Philadelphia.

Admiral Bowles' authority also extends to the Merchants' Shipbuilding Company at Bristol, Penn., and the Submarine Boatyard at Newark, N. J. A statement issued by Admiral Bowles asserted that nothing would be permitted to stand in the way of getting the yards into effective operation in the shortest possible time.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN INSTITUTE OF MINING ENGINEERS, 29 West 39th St., New York; Feb. 18-21, New York.

AMERICAN RAILWAY ENGINEERING SOCIETY, 910 Michigan Ave., Chicago; Mar. 20-22, Chicago.

The Savannah, Ga., Chapter of the American Association of Engineers was formally instituted, Jan. 26, at a banquet held at the Hotel Savannah. There are 23 charter members of the chapter. A. H. Krom, secretary of the American Association of Engineers, presented the charter to T. M. Chapman, president of the chapter. The other officers are: S. M. Gibbs, vice president; W. A. Whitfield, treasurer, and O. T. Illerich, secretary.

At the meeting of **The New York City Chapter of the American Association of Engineers**, held at the Hotel McAlpin on Feb. 13, H. H. Bubar, of the National Aniline & Chemical Co., spoke on "The Engineer: His Present and Future."

The third and last meeting for the season of the **New York Section of the American Water-Works Association** will be held on the afternoon of Feb. 20 at the Park Avenue Hotel. A governor will be elected to take the place of Allen Hazen, whose term has expired.

At a meeting of **The Canadian Society of Civil Engineers**, Jan. 24, per-

mission was granted for the establishment of a Montreal branch of the society.

The **Ohio Engineering Society** has elected the following officers for 1918: President, T. J. Smull, College of Engineering, Ada; vice president, Ett S Smith, city surveyor, Youngstown; secretary-treasurer, John Laylin, Norwalk.

At the annual meeting of **The Engineers' and Architects' Association of Southern California**, held in Los Angeles Jan. 24, the following officers were elected: H. Z. Osborne, Jr., president; J. J. Backus, first vice-president; H. L. Smith, second vice president; A. B. Benton, G. E. Bergstrom, A. H. Koebig and G. P. Robinson, directors.

The regular Wednesday luncheon of **The San Francisco Electrical Development League** Jan. 30 was "Civil Engineers' Day." H. J. Brunnier, vice-president of the San Francisco Association of Members of the American Society of Civil Engineers, gave an introductory talk on "Coöperation Between Civil Engineers and Electrical Men." Prof. Charles D. Marx, of Stanford University, spoke on "The Relation of Technical Training to Wartime Activities." Prof. Charles G. Hyde, University of California, told of "The Relation of the University, as an Institution, to Wartime Activities." Nathan A. Bowers, Pacific Coast editor, McGraw-Hill Co., was chairman of the day.

The Engineers' Club of Kansas City, Mo., held its sixth annual banquet at the University Club, Jan. 29. A service flag of 23 stars was unfurled and the club by unanimous vote instructed the secretary to send telegrams of greeting to each man of the service and elected all of these men honorary members for the period of the war. J. E. Freeman, of the technical division of the Portland Cement Association, spoke on concrete ships. His address was illustrated with motion pictures and lantern slides. The officers elected for 1918 are: President, Alfred Hurlburt; first vice-president, F. B. Scheetz; second vice-president, A. C. Everham; secretary, Robert S. Beard; Executive Committee: H. P. Treadway, Ralph R. Benedict and William Bugg.

PERSONAL NOTES

WILLIAM C. HOAD, professor of sanitary engineering at the University of Michigan, and consulting sanitary engineer, Ann Arbor, Mich., has been commissioned as major in the Sanitary Corps of the National Army, and will be detailed for important work in camp sanitation in the various camps and cantonments throughout the country. His headquarters will be at the office of Surgeon General Gorgas, in Washington. For the period of five years from 1907 to 1912 Major Hoad was chief engineer of the Kansas State Board of Health, and was in charge of the engineering administration of the state water and sewage law. For the past six years he has been professor of sanitary engineering at the University of Michigan.

RALPH A. BEEBEE, constructing engineer with the Federal Telegraph Co., has accepted the newly created position of technical adviser to the mayor of Oakland, Calif. Mr. Beebee headed the list of engineers best qualified for this position, which was prepared by Prof. C. D. Marx, of Stanford University, at the request of Mayor Davie, of Oakland. Mr. Beebee was graduated from Stanford in 1907 and in the three years following had general experience in municipal engineering, particularly in connection with sewer and water systems. Since 1910 he has been with the Federal Telegraph Co. The work in Oakland for the present will be in connection with a study of the traction company and power company properties, with a view to municipal ownership.

JAMES B. GIRAND has resigned as city engineer of Phoenix, Ariz., to devote all his time to a big hydro-electric project in the Grand Canyon of the Colorado River. Eastern capitalists are said to be interested in the project, which will involve an ultimate outlay of $12,000,000. A description of the surveyors' camp on this project was printed in *Engineering News* of Aug. 17, 1916, p. 306.

P. D. COX, formerly superintendent of construction for the Braden Copper Co., has gone to Santiago, Chili, as representative of the Consolidated Rolling Mills and Foundries Co., New York.

H. W. SKINNER, formerly mechanical engineer for Jarvis Hunt, architect, Chicago, is now supervising engineer in charge of work on the main plant in connection with increasing water filtration and enlarging the pumping plant at the U. S. Naval Training Station, Great Lakes, Illinois.

H. W. KLAUSSMANN has become city engineer of Indianapolis and president of the Indianapolis Sanitary Commission, charged with providing improved means of sewage and garbage disposal for the city. He succeeds B. J. T. Jeup.

THOMAS A. STROUP, formerly with the Utah Copper Co., has become engineer of design and construction of the Minerals Products Corporation, which is building a plant for producing potash from alunite at Marysvale, Utah.

F. W. CAPPELEN, city engineer of Minneapolis, has been appointed a member of the Minnesota State Board of Health, which now consists of two engineers and seven doctors. The other engineer member is L. P. Wolff, consulting engineer, St. Paul, Minnesota.

J. H. PARDEE, president of the J. G. White Management Corporation, New York, and J. P. Ripley, engineer, have returned to New York from a general inspection of the Manila Electric Railroad and Light Co., and other interests in the Philippine Islands operated by the corporation.

G. G. WICKLINE, formerly with the City of Dallas, Tex., has been appointed bridge engineer for the Texas State Highway Commission.

GEORGE H. SHAW, for the past five years sanitary engineer, U. S. Department of Agriculture, has been appointed sanitary engineer with the U. S. Shipping Board and Emergency Fleet Corporation, in the Department of Health and Sanitation, of which Maj. P. S. Doane is director. For six years Mr. Shaw was assistant engineer, designing division, Board of Water Supply, New York City.

SEDLEY H. PHINNEY, formerly with the Illinois State Highway Department and for the past two years with the bridge department of the New York Central R.R., at Cleveland, has been appointed acting secretary of the Bureau of Municipal Research, Philadelphia.

WILLIAM B. GRAY, who was general superintendent for H. S. Kerbaugh, Inc., for 12 years, and was recently commissioned a major in the Engineer Officers' Reserve Corps, has been made constructing quartermaster in charge of constructing the large ordnance depot near Harrisburg, Pennsylvania.

OBITUARY

WILLIAM T. EMMET, a member of the Public Service Commission for the Second District, New York State, since March, 1914, died Feb. 3, at his home in New York City. Mr. Emmet was a lawyer and was formerly state superintendent of insurance.

CHARLES W. GAY, who was city engineer of Lynn, Mass., from 1902 to 1908, died in Lynn, Feb. 1, at the age of 70. Mr. Gay was born in Norwood, Mass., in 1848. He had an important part in the laying out of the park system of Washington.

T. F. SINCLAIR, contractor, of Vancouver, B. C., died there, at the age of 68, on Jan. 31. He built the new Westminster water-works plant, constructed a section of the Canadian Pacific Ry. through the mountains, and engaged in many other important works.

JOHN A. ZABRISKIE, 86 years old, well known as a railroad builder many years ago, died at Yonkers, N. Y., Feb. 6. Among the railroads constructed by Mr. Zabriskie were the New Jersey Southern, the New York & New Jersey, Erie Short Cut, and divisions of the Long Island and West Shore railroads.

JOSEPH SHARPE, contractor, Paterson, N. J., died Jan. 22, in his seventy-eighth year.

INDUSTRIAL NEWS AND COMMENT

ABOUT MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Enlisting America's Industries in War Production

Makers of Construction Equipment Are Speeding Work on Machinery for the Front and for Use Behind the Lines

Concrete mixers building big gun emplacements, steam pumps keeping the dugouts dry, motor trucks by the thousands, all with familiar American nameplates—these are the surface indications that Industrial America is "enlisted" in the war just as truly as any "doughboy" in the trenches.

Not only are the builders of big guns, the arms and ammunition makers, enrolled in this industrial army, but practically every maker of construction and engineering equipment is "doing his bit," serving either the Government or the war industries.

Production is being speeded up on this work. Output that was deemed impossible in normal times is being attained. The demand for increased production is met in the face of a labor shortage. Locomotive cranes are helping to rush yard work and building erection.

Makers of this equipment report heavy sales. The scope of work of other equipment has been widened. For instance, revolving steam shovels, equipped with structural steel booms by their makers, are now widely used for locomotive crane service.

How the industries are responding to this call for war service and wartime production is indicated by the following review:

For the Agricultural Army

J. I. Case T. M. Co., Racine, Wis., manufacturer of tractors, says:

"We are not engaged in the manufacture of ammunition or other special fighting material for use of our Government in carrying on the present war. We are, however, busily engaged in turning out thousands of Case farm tractors and other power farming machinery, so necessary at this time for the increased production of foodstuffs. This product is not only extensively sold in this country, but foreign countries like Italy, Greece, France and Ireland have purchased Case power farming machinery, principally the tractors, thresners, plows, etc., in large numbers, in view of the scarcity of horse and man labor.

"It might also be interesting for you to know that over two hundred employees of this company have left our employ so far this year to serve Uncle Sam."

Morris Machine Works, Baldwinsville, N. Y., builders of dredges, centrifugal pumps and pumping engines:

"For many years past we have specialized in the higher grade of centrifugal pumps and we have been successful in equipping many battleships of our fleet.

"Due to the large number of ships now being built, we are particularly busy in our centrifugal circulating pump department. These pumps are used for furnishing water to surface condensers. This department now practically dominates our works. We are building hundreds of these pumps for the various shipbuilding companies.

A Three Months' Job in Ten Days

"About three months ago we received a telegraphic order from our Southeastern office at Charlotte, N. C., covering three large pumping units for the Columbia, S. C., cantonment. Under ordinary conditions, we would require from two to three months to get out these pumps, as it was necessary to make up new patterns and sets of drawings. As the cantonment was then practically finished, we were requested to see if it was not possible to ship this contract in not to exceed three weeks.

"This entire work was given preference throughout our plant, and the complete castings were in the machine shops within a week. The three pumps on their special frames for electric motors were expressed in ten days after receipt of the order.

"We give this example just to show what actually can be done when required. Were we asked to complete such a contract in ordinary times, we would have said that it was impossible."

Continue Their Regular Work

Allis-Chalmers Manufacturing Co., construction, mining and industrial machinery:

"The Government found on investigation that our standard products were in such general demand by people who had Government contracts, and so much of it could be used by the Government, that they have determined thus far to let us proceed with our regular lines. We have large orders in our various departments and are increasing our facilities."

Westinghouse Church Kerr & Co., New York, engineers and constructors:

"Prior to the United States entering the war, W C. K. had been prominently connected with important work for the industries of the country. This made it possible for them to meet the war's demands upon them.

"Among other things we had built a complete arsenal and extended another, a small-arms plant, a complete powder plant, two shell-loading plants, an airplane motor plant, a nitrogen-fixation plant, a sulphur mining plant.

"And we had been working continuously for the Winchester Repeating Arms Co. for five years."

Working for War Industries

Thomas Elevator Co., Chicago, makers of steam and electric hoists for building construction:

"We are devoting our entire efforts to orders which are either directly or indirectly for the Government. Our principal product at the present time is electric derrick hoists for the ship yards, several of which are in the course of manufacture, with many more on order.

"We are not putting forth any effort on orders where the hoists are to be used in connection with nonessential industries but are bending every effort in our power to speed up and facilitate our production on hoisting equipment for the shipyards."

Chris. D. Schramm & Sons, Philadelphia, makers of contractors' power-driven equipment:

"Besides our direct Government work we are supplying contractors working on Government contracts with Schramm portable air compressors, hoists, pumps and concrete mixers. The Pittsburgh-Des Moines Steel Co. used Schramm portable air compressors when they erected two steel tanks, at Fort Oglethorpe, Ga., in 30 days, which was record time."

Construction Tools For War

McKiernan-Terry Drill Co., New York, manufacturers of rock drills, air compressors, pile hammers, etc.:

"At the present time almost all the work we are doing is directly or indirectly for the benefit of the Government. Within the past year we have doubled the capacity of our works. It is not unlikely that we shall make further plant extensions. Just now at least one-half of our manufacturing capacity is for Government account and in a line entirely new to us since 1914.

"The armies abroad are using rock drills; they also use pile hammers; both of these are part of our regular line of manufacture. Mining, since 1914, has been carried to an extent never before attained. You can't mine without rock drills. In new construction, the direct result of the war, rock drills and pile hammers have been important elements in speedy building. To these needs we have been a contributor.

"Never before were so many piles, steel, wood and concrete, driven as now. Shipyards alone have absorbed a mighty forest of wood piles. Many of these are driven with our pile hammers.

"'Over there' our pile hammers have been moved up close to the front. The armies have their own special need for them. It is with much satisfaction that we may say that the requirements made of us in the lines mentioned have been met promptly, notwithstanding the many difficulties incident to getting raw material in sufficient quantity."

Slag Manufacturers Organize

At the first meeting of the National Slag Association, held recently in Chicago, the plan to be followed by the organization was outlined.

It is intended to investigate and publish the technical merits of blast-furnace slag for construction work in fields where its use has already been developed or may be extended. The Association will coöperate with other commercial associations, technical societies and laboratories. The following officers were elected: President, F. E. Sarstadt, of the Cleveland Macadam Co., Cleveland, Ohio; vice-president, C. E. Ireland, of the Birmingham Slag Co., Birmingham, Ala.; Secretary, H. J. Love, of the Standard Slag Co., Youngstown, Ohio; Treasurer, W. A. Brewer, of the Duquesne Slag Products Co., Pittsburgh, Penn.

Temporary offices are located in Youngstown, Ohio, and a permanent office of the Association will be opened soon in Cleveland.

Naming the Infant Product

"Yes, we shipped the six 'Hexon' saws yesterday," said the sales manager into the 'phone. (The equipment wasn't saws, neither was the name "Hexon," but both will serve for the purpose of this little narrative.)

"But you don't make 'Hexon' saws," said the industrial editor, who sat beside the sales manager's desk.

"I know it," replied the sales manager, as he hung up the receiver, "and the customer knows it—but all equipment of the same general type as 'Hexon' saws is called 'Hexon' by the contractors. The name has almost acquired the currency of the word 'kodak.' It has become descriptive of this class of equipment and has nearly lost its identity as a trademark name."

The incident suggests that trade names of new types of equipment generally go through this transition with a partial loss of identity. It suggests, too, the desirability of tying the name of the maker to the name of the equipment for the purpose of preserving the identity of the manufacturer, even after the trademark name of the specialty takes its place in industrial nomenclature.

Coal and Coke Movement Starts with the Thaw

Motive Power Mobilized in the East—New Priority Classifications Expedite Production

Coming of the long-sought-for thaw gave impetus to coal and coke movements upon which the iron and steel industries were waiting. Motive power was transferred to the Western roads, and new locomotives, which were on their way to the West, were commandeered for service in the traffic jam in the Pittsburgh district.

With the concentration of effort on the movement of coal and coke, steel men look for a speedy resumption of blast furnace operation.

Steam-coal movements increased as soon as the weather relaxed its grip on the railroads. The carriers took full advantage of the respite.

Manufacturers of iron and steel products expect that the new classifications announced by the War Industries Board will expedite shipments. Each order for equipment or material placed for war supplies will carry a classification which indicates its relative importance in the Government's war program.

All work is divided into four general classes: Class AA, which must take precedence in all plants over everything else, will comprise only emergency war work of a special or urgent nature. Class A comprises all other war work, such as arms, ammunition, destroyers, submarines, airplanes, locomotives, etc., and the materials of commodities required in their production. The third class, designated B, will include work not primarily designed for the prosecution of the war, but being of public interest and essential to the national welfare. The final class, C, for which no certificates will be issued, will comprise all other work.

The statement issued by the War Industries Board says:

"The classification of an order simply means that it shall be given such precedence over orders of a lower classification as may be necessary (and only such as may be necessary) to insure delivery on the date specified in the order."

Industrial News Notes

The Concrete Mining and Placing Co., manufacturer of pneumatic mixers, has moved its Chicago office from 123 West Madison St. to the First National Bank Building.

The H. Kleinhans Co., Union Arcade Building, Pittsburgh, Penn., dealer in heavy contracting and railroad equipment, has opened a New oYrk office at 30 Church St., New York ,to handle Eastern business.

This company has acquired 10 acres of property in the Pittsburgh district at Glenshaw, Penn., and is erecting an up-to-date repair shop, the main building being 125 x 90 feet.

C. E. Forsythe, 30 Church St., New York City, dealer in construction equipment, recently returned from a "swing round the circle" in the South. He visited Austin, San Antonio, Houston, New Orleans and Atlanta, selling four locomotive cranes during the journey. "Business is active throughout the South," says Mr. Forsythe, "but I was particularly impressed by the amount of construction under way in San Antonio. A 22-story hotel and a number of office buildings are being erected."

A new company, the Columbus Conveyor Co., has been organized in Columbus, Ohio, to build and market wagon loaders and unloaders and conveying machinery. O. A. Wheaton and C. W. Belt, of Columbus, are the organizers. Mr. Wheaton was previously sales manager of the Sunberry Mfg. Co.

After the recent death of C. C. Williams, president of the G. A. Williams Co., Erie, Penn., manufacturers of excavating equipment, the appointment of Edwin F. Jones as manager of the company was announced. Mr. Jones has been in charge of the sales work of the company for the past three years.

A charter of incorporation has been granted to the Erie Pump and Engineering Co., of Erie, Penn. The company will manufacture and sell centrifugal pumps of the sand-gravel-dredging type, also pumps for clear-water service, conveying and elevating machinery for coal, sand and gravel.

The used equipment and machinery business formerly conducted by Howard B. Payne, under the name of the Front Construction Co., will be carried on after Feb. 1 by Howard B. Payne individually, at 1003 House Building, Pittsburgh.

C. B. Filbert, representative of the United States Asphalt Refining Co. and Bitoslag Paving Co. in Pennsylvania, has been commissioned as a captain in the Engineers' Corps, National Army, and will be attached to the road building branch of this service.

A contract for the erection of a filtration plant and waterworks system for the cantonment at San Juan, Porto Rico, has been let to the Roberts Filter Manufacturing Co., of Darby, Penn. The work will cost nearly $300,000. This company has been devoting all of its effort to Government work, having recently completed filtration plants at Camp Meade, Newport News, Hog Island and the Naval Academy at Annapolis.

Daniel T. Pierce Goes To France

Daniel T. Pierce, who has been for several years executive assistant of the General Asphalt Co., and who recently organized the information department of the American International Shipbuilding Corporation, will sail for France next week on a special mission for the Red Cross.

Caterpillar Tractors Buck Snow

During the recent blizzard the street commissioners of Peoria, Ill., put two Holt caterpillars, each dragging a road grader, at work fighting snow. The central part of the city was quickly cleaned up. V-shaped snow plows, 10 ft. wide, were substituted for the graders after trial.

Coast Lumbermen Aid War

To promote greater efficiency in the handling of Government contracts, the War Service Bureau of the West Coast Lumbermen's Association has been reorganized. The name of the bureau has been changed to the West Coast Emergency Lumber Bureau, and branch offices will be established in Seattle, Wash., and Portland, Ore. Headquarters of the bureau will be continued in Tacoma, with George S. Long in charge.

Water Meter "Audit" Checks Waste

What is believed to be a new development in the water conservation movement has been inaugurated by the Water-Works Equipment Co., of 50 Church St., New York. The method is termed a "yearly audit" of water meters. It involves a careful check on water meters in all the large industrial works in a city. The Lanham Mangraph is employed in connection with Pitot tube. These "audits" have been applied recently in Perth Amboy and Rahway, N. J., with good results.

The "audit" is not planned to replace the more complete "water waste survey," but to supplement it. Good results attained by a water-waste survey are often subsequently lost by failure to maintain the accuracy of large industrial works water meters. The "audit" stops loss of revenue due to meter inaccuracy.

American Catalogs Wanted in Mexico

A large library of foreign catalogs will be established in the commercial museum recently reorganized in the old Museum of Technical Industries in the City of Mexico. Translations will be made free of charge for visitors. The Mexican Department of Commerce and Industry has charge of the new library.

APPLIANCES AND MATERIALS

New Flood-Lighting Projector

As a further development of their line of "Golden Glow" and "Crystal Mirror" flood-lighting projectors, the Electric Service Supplies Co., Philadelphia, has placed on the market a new flood-lighting unit to be known as type FL-1419.

TYPE FL-1419 PROJECTOR MAY BE USED WITH TWO DESIGNS OF REFLECTORS

This new type of projector is particularly designed for short-range work, where a wide beam dispersion is desired. The projectors are equipped with 14-in. long focus type parabolic "Golden Glow" or "Crystal Mirror" reflectors, which project, respectively, powerful, dispersed beams of rich golden light and white brilliant light.

A Compact Grinder for Contractors

For squaring the shanks of drill steel and general grinding work, the Ingersoll-Rand Co. has brought out the "Little David" pedestal grinder. It uses an 8-in. grinding wheel with a 1-in. face, in the standard size. The grinder operates on compressed air and occupies a floor space of 17 in. x 20⅜ inches.

The Walter A. Zelnicker Supply Co., of St. Louis, has just established permanent offices at Minneapolis, Minn., 627 Plymouth Bldg., to serve the North Central and Canadian trade.

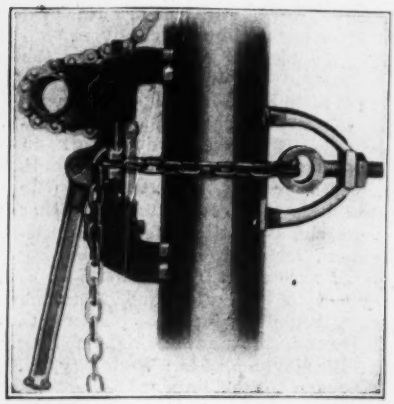
For a Long Sight on a Plumb-Bob

A metal target designed to permit long sights on plumb-bob string is being distributed among engineers by the Armco Iron Culvert and Flume Manufacturers' Assn., Middletown, Ohio. The target is elliptical, 2-in. x 4-in. size, and weighs only one ounce. It is colored red and white, like a level target.

Pipe Vise Is Portable

The portable pipe vise shown in the accompanying view can be secured readily to any convenient support. It consists of two main parts connected by a chain. The base casting has feet recessed in V-shape, so that it can be fitted to a round, square or flat support. Holes in lugs on these feet provide for bolting the part in place if it is to be used for any length of time. This casting is placed on one side of the support and on the opposite side is an arch-shaped clamp having an eye-bolt through which passes a chain attached to the base casting.

When the two parts are in place, the chain is hitched to a lug on the casting, and is then drawn tight by screwing up the nut on the eye-bolt, thus securing the vise in place. A set of jaws and a chain provide for holding the pipe which is to be threaded or cut. With this chain held by a lug it is drawn tight upon the pipe by means of a cam on a pivoted lever. The view shows the vise attached to a round timber and having a pipe secured on the jaws. This appliance is made by the Gerolo Mfg. Co., Chicago.



THIS PIPE VISE CAN BE ATTACHED TO ANY CONVENIENT SUPPORT

Trade Publications

The Browning Co., Cleveland, Ohio, has issued a new catalog describing different types of buckets made by this company. Tables of dimensions and weights are included.

Havemeyer bars and other concrete reinforcing products are illustrated and described in a new catalog issued by the Concrete Steel Co., 42 Broadway, New York.

Brownhoist buckets and tubs are described in Catalog E, just issued by the Brown Hoisting Machinery Co., Cleveland, Ohio. This contains line drawings, tables of sizes and capacities and illustrations showing application of the different types of buckets.

Zelnicker's Bulletin No. 230, Holiday Edition, is being sent out by the Walter A. Zelnicker Supply Co., St. Louis, Mo. It lists second-hand rails, locomotives, cars, cranes, steam shovels, etc.